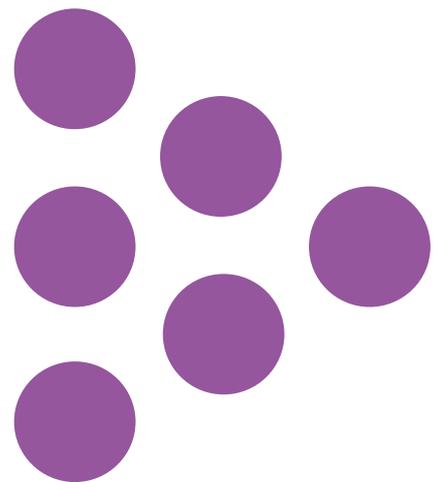

Report

PISA 2018 additional analyses: What differentiates disadvantaged pupils who do well in PISA from those who do not?

National Foundation for Educational Research (NFER)



PISA 2018 additional analyses: What differentiates disadvantaged pupils who do well in PISA from those who do not?

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Executive Summary

Social mobility and improving the performance of disadvantaged pupils is a focus for policy in England, Northern Ireland and Wales. The findings from PISA 2018 provide a unique opportunity to explore the impact of disadvantage on pupils aged 15, to contextualise achievement outcomes with information about home-life and school, as well as providing an international perspective.

How well are England, Northern Ireland and Wales doing at supporting the reading, maths and science performance of disadvantaged pupils compared with other countries, and has this changed over time?

In all participating countries, more advantaged pupils performed better than their disadvantaged peers in reading, maths and science. Wales had more equitable outcomes, on average, than in England; the gap in performance between most- and least-disadvantaged pupils was statistically significantly greater in England than in Wales for reading, maths and science. Northern Ireland sits somewhere in the middle, as the gap between most- and least- disadvantaged pupils was not significantly different from either England or Wales.

It is possible to be high achieving and have comparatively good equity in education. Countries previously identified as having greater equity in their education include Macao (China), Estonia and Canada; three countries which also outperformed England, Northern Ireland and Wales in all three PISA domains in 2018. Estonia and Canada, therefore, have been chosen as the comparator countries for this research alongside the Republic of Ireland.

In England, Northern Ireland and Wales, socio-economic background had a smaller impact on performance amongst some of the most disadvantaged pupils than for their more advantaged peers. That is, there was a smaller difference in average achievement between a disadvantaged pupil and a marginally less disadvantaged peer but a larger difference in achievement between an advantaged pupil and a marginally less advantaged peer. In England, pupils who were more advantaged performed similarly to their peers in Canada and Estonia, indicating the importance of successfully improving the performance of disadvantaged pupils.

Reading was assessed in greater depth in PISA 2018. The gap between disadvantaged pupils and their non-disadvantaged peers was similar for all three reading processes: locating information; understanding; and evaluating and reflecting. This indicates there was no process in which disadvantaged pupils were disproportionately weak.

Encouragingly, in England, Northern Ireland and Wales, the 2018 average scores for disadvantaged pupils in maths and reading were significantly higher than in previous cycles. Disadvantaged pupils' performance in science in each of the three countries has remained stable over time, whilst it has decreased in the comparator countries.

How do resilient pupils' (high-achieving, disadvantaged pupils') attitudes differ from similarly-performing pupils' from more advantaged backgrounds?

Around a third of the disadvantaged pupils in England, Northern Ireland and Wales were defined as 'resilient'. Resilient pupils are amongst the 33% most socio-economically disadvantaged pupils in their country who achieve at or above "level 3" in PISA reading, maths and science; or, more simply, they are disadvantage pupils who, despite the odds, have attainment in PISA of a level considered to equip them for success in later life.

For the most part, there were no attitudinal differences found between resilient pupils and their similarly-achieving, more affluent peers. For example, no differences were found between pupils' sense of belonging at school, life satisfaction or future aspirations. The exception to this was in Northern Ireland, where resilient pupils were less confident in their reading than their more affluent peers.

It was mainly indicators of family poverty which distinguished these pupils. Whilst it is perhaps unsurprising that wealth indicators demonstrate the differences between resilient pupils and those who are not disadvantaged and similarly achieving, it does emphasise that households need sufficient household income to enable children to widen their horizons.

In what circumstances do disadvantaged pupils tend to overcome barriers to perform better and how do their attitudes differ from low-performing disadvantaged pupils' from similar backgrounds?

Resilient pupils tended to use metacognitive strategies, had a growth mind-set and had high aspirations for their future education or careers. They were also less likely to truant. Resilient pupils were less likely to report having found meaning in life and less likely to report regularly feeling positive emotions; these unexpected findings would benefit from additional research to understand further.

Are there lessons that can be applied more widely?

Drawing on our findings around resilient pupils we recommend:

- programmes that support metacognition could be beneficial for disadvantaged pupils
- work towards countering the belief that intelligence is fixed for disadvantaged pupils
- further investigation into the connection between aspiration and resilience to identify how they are related and, therefore, how and where more targeted support would be most beneficial for disadvantaged pupils.

1 Introduction

Differences in achievement between disadvantaged pupils and their more advantaged peers are a focus for policy in all parts of the UK. A gap in educational outcomes between pupils from less-affluent backgrounds compared to their peers is evident by the time they start school and only widens as they move through the school years (EEF, 2017).

Disadvantaged pupils are more likely to leave school without GCSEs in English and maths than their peers (Children’s Commissioner 2019; EEF, 2017; Burn, 2015) and are underrepresented in professional occupations (Social Mobility Commission, no date). This means it is vital to understand ways in which we can support disadvantaged pupils, and ensure that they are given the tools they need to overcome barriers and succeed in later life. Whilst this is always an essential task, it has become even more important at a time when COVID-19 appears to have increased the negative impact of disadvantage on educational success (OECD, 2020).

In 2018, nearly 80 countries participated in the Programme for International Student Assessment (PISA). PISA assesses 15 year olds’ proficiency in reading, maths and science and collects data on a wealth of background factors via questionnaires from pupils, teachers and school leaders. This provides a unique opportunity to explore the impact of disadvantage on pupils from an international perspective, as well as a comparison across England, Northern Ireland and Wales¹ on the devolved matter of education.

This report focuses on reading, mathematics and science performance in PISA to answer three questions:

1. How well are England, Wales and Northern Ireland doing at supporting the reading, maths and science performance of disadvantaged pupils compared with other countries, and has this changed over time?
2. How do resilient pupils’ (high-achieving, disadvantaged pupils’) attitudes differ from low-performing pupils’ from similar backgrounds and similarly performing pupils’ from more advantaged backgrounds?
3. In what circumstances do disadvantaged pupils tend to overcome barriers to perform better, and are there lessons that can be applied more widely?

¹ This research was commissioned as part of the PISA 2018 national centre for England, Wales and Northern Ireland. Analysis of Scotland was out of scope.

2 Background

Social mobility and improving performance of disadvantaged pupils is a priority for all parts of the UK

In England, Wales and Northern Ireland, 'disadvantaged' is primarily defined and measured as those pupils in receipt of free schools meals (FSM) or who have been recipients at any given point in the previous six years (EverFSM). A small number of looked after and adopted children are also classed as disadvantaged but do not feature in this study.

Reducing the difference in achievement between disadvantaged pupils and their more advantaged peers is a focus for policy in all parts of the UK. The Social Mobility Commission is an independent body established to assess progress in improving social mobility in England, Wales and Scotland. In their 2019 State of the Nation report they found that social mobility had stagnated in England over the previous four years, but improved in Wales (Social Mobility Commission, 2019). The Equality Commission for Northern Ireland issued a statement on educational inequality in October 2017 which concluded that 'despite the fact that overall levels of attainment are increasing, many of the attainment gaps between the equality groups are also increasing' (Equality Commission, 2017, page 3).

In England, there is evidence that the disadvantage gap stopped closing between 2015 and 2019 and there are indications this gap has widened (Hutchinson *et al.*, 2020). In July 2020 the Education Minister in Northern Ireland announced the appointment of an expert panel to examine the links between educational underachievement and social disadvantage. An online survey was launched in September 2020 engaging various stakeholders, with the aim 'To examine links between persistent educational underachievement and socio-economic background' (Department of Education, 2020). The Welsh Government has announced plans to commence its socio-economic duty in March 2021, which will place a legal requirement on specific public bodies to consider how their decisions might help to reduce the inequalities associated with socio-economic disadvantage (Welsh Government, 2020).

The COVID-19 pandemic is likely to have a disproportionate impact on economically disadvantaged pupils (Children's Commissioner 2020; Montacute, 2020; Sharp *et al.*, 2020) and the Education Endowment Foundation estimates that school closures in England are likely to have widened the attainment gap between disadvantaged pupils and their peers, reversing the progress since 2011 (EEF, 2020a). Whilst the data in this report was collected prior to the COVID-19 pandemic, the findings, in combination with other research, could be used to strengthen the support given to disadvantaged pupils in an attempt to lessen the impact of the pandemic on their future.

2.1 Which policies have supported the PISA 2018 generation by aiming to improve attainment outcomes for disadvantaged groups?

The PISA 2018 cohort in England, Northern Ireland and Wales, born in 2002/03, has experienced many policies with the overarching aim of improving attainment for all pupils, as shown in Table 1.

Table 1 Education policy timeline for the PISA 2018 generation

School year	Cohort age in autumn	England events	Northern Ireland events	Wales events
2003	0	National Literacy Strategy (from 1997) London Challenge launched May 2003	School self-evaluation: Together Towards Improvement I	-
2004	1	-	-	Key stage tests discontinued
2005	2	Free early education for all 3-year-olds	Established the Common Funding Scheme	-
2006	3	Rose Report recommends systematic synthetic phonics	Sure Start widened to cover education outcomes Extended Schools launched	-
2007	4	City Challenge launched April 2008	Northern Ireland curriculum introduced	-
2008	5	National roll-out Every Child a Reader KS3 tests discontinued	Every School a Good School April 2009	-
2009	6	-	-	-
2010	7	Academy acceleration Commitment to expand Teach First & school-led Initial Teacher Training	-	-

School year	Cohort age in autumn	England events	Northern Ireland events	Wales events
2011	8	Pupil Premium introduced Education Endowment Foundation established EBacc performance measure introduced	Count, Read: Succeed Review of GCSE policy	Welsh-Medium Education Strategy April 2010 School banding introduced
2012	9	Pupil Premium extended to ever-6 Year 7 catch-up premium introduced	Assessment of Communication using Levels of Progression introduced Understanding Difficulties in Literacy Development: Continuing Professional Development 2012-15	Regional consortia working from Sept 2012 Standardised tests in reading and numeracy from May 2013 Pupil Deprivation Grant introduced
2013	10	-	Literacy & Numeracy Signature Programme 2013-15 Promoting Improvement in English and Mathematics 2013-15	National Literacy and Numeracy Framework statutory September 2013
2014	11	Revised national curriculum for most subjects Maths Hubs established	-	-
2015	12	Reformed GCSEs first teaching DfE Single Departmental plan 2015 (withdrawn 2017)	-	Revised programmes of study for English, Welsh and maths
2016	13	Revised national curriculum for English	Policy on Qualifications market and GCSE Grading	-

School year	Cohort age in autumn	England events	Northern Ireland events	Wales events
		came into force for all year groups Opportunity areas launched		
2017	14	Progress 8 performance measure Social mobility plan Strategic School Improvement Fund (to 2018) Teaching and Leadership Innovation Fund (to 2020) Rollout of secondary teaching for mastery of maths begins (total planned reach 1,700 schools by 2023)	-	Welsh in Education Action Plan December 2017

Education is an area of devolved government in the UK, with each country making decisions on the education system independently. We provide a spotlight on each country below, identifying the key policy initiatives which focus more specifically on improving attainment outcomes for disadvantaged groups during the PISA 2018 cohort's experience of primary and secondary schooling. The policies largely target literacy and numeracy, as these underpin attainment in other areas of learning.

While many policies aim to tackle socio-economic disadvantage, it is important to note that there are other characteristics which are disproportionately associated with disadvantage and also lower attainment, for example, special educational needs and some ethnic backgrounds. Findings from PISA 2018 (OECD, 2019e) illustrate other factors which could affect attainment. For example, UK school leaders of disadvantaged schools were more likely than their counterparts in more affluent schools to report that the capacity to provide teaching was hindered, at least to some extent, by a lack of teaching staff.

With regards to early childhood (from age 2 upwards), this cohort in all three countries would have had access to the support offered by Sure Start, an initiative aimed at families

living in disadvantaged areas by supporting various aspects of preschool children's development including learning, social and emotional skills and health and well-being.

England: Pupil Premium, EEF and building on the Opportunity Areas

The Pupil Premium, introduced in 2011 when this cohort was aged 8/9, is funding provided to publically funded schools in England to support the education of disadvantaged pupils. It comprises a payment per pupil eligible for FSM in year groups from Reception to Year 11. The Department for Education (DfE) stated it expected to achieve a significant positive impact on the attainment gap in primary schools by 2015, and in secondary schools by 2020 (National Audit Office, 2015), although more recently it has been called into question whether this funding is being used as intended (for example, Education Select Committee, 2019).

The Education Endowment Foundation (EEF) was established in 2011 alongside the introduction of the Pupil Premium. It aims to identify, fund and evaluate educational innovations which meet disadvantaged pupils' needs. This involves establishing evidence of effective interventions and strategies, which work at scale, and encouraging schools, government, charities and others to apply this evidence. The EEF has funded projects that, after rigorous evaluation, have shown the potential to improve pupils' attainment are termed Promising Projects (EEF, 2020b). These projects (including, for example, peer tutoring), have enabled pupils to make +3 months of additional progress in a year, with some projects particularly benefitting pupils eligible for FSM, who made on average +4 months' additional progress. These programmes are mainly being delivered in primary schools, but include one-to-one tutoring and embedding formative assessment at Key Stages 3 and 4.

In 2017, DfE published a social mobility plan, *Unlocking Talent, Fulfilling Potential* (DfE, 2017). In the more recent State of the Nation report, the Social Mobility Commission said 'In December 2017 the DfE took a concrete step towards recognising the critical importance of the role of education in social mobility by publishing its plan for social mobility through education. This was the first time there was a meaningful and tangible commitment to social mobility in the form of a department-wide plan' (Social Mobility Commission, 2019, page 36). This plan builds on the Opportunities Areas programme, in which extra funding was made available to 12 local authority district areas (LADs), targeted because of the social, economic and cultural challenges they faced in improving people's life chances. The aim of this programme is to build young people's knowledge and skills and provide them with the best advice and opportunities. The PISA cohort would have had a maximum of one year exposure to schemes supported under this programme.

Northern Ireland: Common Funding Scheme, the Delivering Social Change Literacy and Numeracy Programme and Count, Read: Succeed

The Common Funding Scheme (CFS), established in 2005 when the PISA 2018 cohort were aged 2, is distributed to schools based on the proportion of children entitled to free school meals. The Targeting Social Need (TSN) component in the CFS, introduced in 2014, provides an extra payment to schools to recognise the additional costs in educating children from socially deprived backgrounds, regardless of ability, and the particular challenges faced in schools with high proportions of disadvantaged children.

In 2012, Northern Ireland commenced the Delivering Social Change Literacy and Numeracy Programme, which aimed to improve literacy and numeracy as part of a wider government initiative tackling poverty and social exclusion. The PISA 2018 cohort was in their final year of primary school in 2013-14 and so would have experienced the full extent of this programme. It aimed to increase the number of pupils in primary and post-primary schools achieving at the expected level or above at the end of Key Stage 2 in both Literacy and Numeracy and at least a grade C or above in GCSE English and GCSE Mathematics.

Other policies which may have had an impact include Count, Read: Succeed: which was introduced in 2011 and focuses on narrowing gaps in educational outcomes, including between the most and least disadvantaged pupils; and Extended Schools, which, from 2006, has targeted disadvantaged communities. Extended Schools aims to enable the provision of more than 3,000 additional services and activities across 500 schools, reaching approximately 43% of all schools and 63% of all pupils entitled to FSM in Northern Ireland.

Wales: Pupil Deprivation Grant and National Literacy and Numeracy Framework

The Pupil Deprivation Grant, launched in 2012, when the PISA 2018 cohort was in its final year of primary school, is one of the Welsh Government's flagship education policies and aims to tackle the impact of deprivation and disadvantage on educational outcomes. Extra funds are available to schools based on the number of pupils eligible for FSM on their roll from Years 1-11. The National Literacy and Numeracy Framework, introduced in 2013 aims to reduce the gaps between pupils with special educational needs or from disadvantaged backgrounds, and their peers.

2.2 What can we learn from PISA?

International surveys provide a unique opportunity to examine the impact of disadvantage on pupils in England, Northern Ireland and Wales

The release of PISA 2018 data in December 2019 provides rich data to look at the reading, maths and science performance of pupils across countries, over time. International large scale assessments, such as PISA, give the opportunity for international comparisons, as well as UK-wide comparisons on the devolved matter of education. PISA measures attainment alongside contextual information, for instance background characteristics, from pupil and school questionnaires.

For PISA, the OECD has developed an alternative measure of socio-economic background, the index of economic, social and cultural status (ESCS). ESCS is calculated as a weighted average of three indices, generated from the PISA questionnaires:

- HISEI – the highest occupational status of a pupil's parents.
- PAREDINT – the highest educational level of a pupil's parents (converted into years of education).
- HOMEPOS – an index of home possessions (measures the availability of 25 household items that act as measurements of family wealth including the number of books at home).

The index is set to a mean of zero across OECD countries, with a standard deviation of one. More detailed information about how the ESCS index is calculated is provided in the [PISA technical report](#).

How is socio-economic status defined in this report?

For the purposes of this report we use the Economic, Social and Cultural Status (ESCS) index as a measure of pupils' socio-economic status. A score on the ESCS index is estimated for every pupil who participates in PISA. ESCS is based on pupils' responses to questions about their parents' background and education, and possessions in their homes. ESCS is a relative measure.

How is disadvantage measured in this report?

Pupils who are amongst the bottom 33% on the ESCS index in their country are considered disadvantaged.

This report, therefore, uses a relative measure of disadvantage within each country, and those considered disadvantaged in a more economically advanced country may nevertheless have a higher ECSC index than many pupils in less economically advanced countries.

The PISA ESCS index provides a more sophisticated measure of disadvantage than the binary 'FSM or not' by measuring socio-economic status on a continuous scale. ESCS takes sociocultural factors into account (Andrade, 2016) and is also available for pupils from every participating PISA country, offering a means for international comparison.

The overlap between pupils who are FSM eligible and amongst the bottom 33% on the ESCS index is presented in Table 2.

Table 2 Proportion of FSM eligible pupils who are amongst the bottom 33% on the ESCS Index

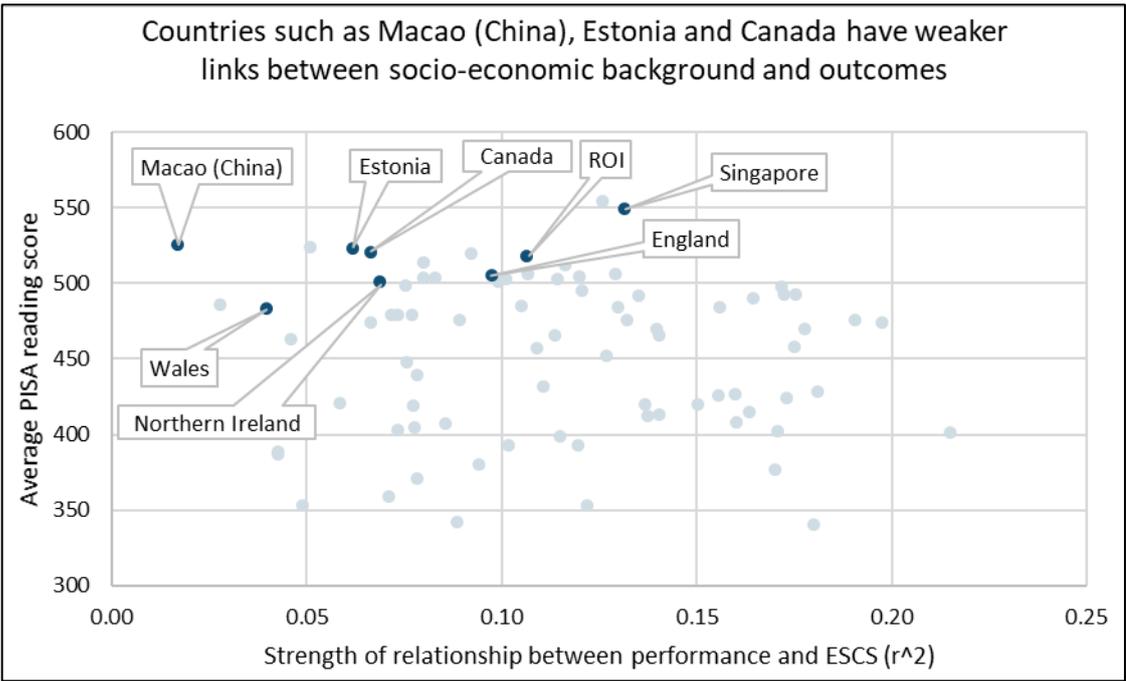
Country	England	Northern Ireland	Wales
%	65	61	67

Socio-economic background has a smaller impact in Macao (China), Estonia and Canada than in other high-achieving countries such as Singapore

'There is no country in the world that can yet claim to have entirely eliminated socioeconomic inequalities in education' – OECD (2018, page 13)

To gain an accurate picture of interactions between attainment scores and the ESCS index, we can look at the **amount of variance in scores** which can be explained by socio-economic background, or **the strength of the effect**. This shows the extent to which the scores of pupils in each country are predicted by socio-economic background, rather than by other variables. Figure 1 shows the strength of the effect that ESCS has on reading performance for all participating countries.

Figure 1 Strength of the relationship between performance and ESCS for all PISA 2018 countries



Source: PISA 2018 database

In PISA 2018, countries varied in the impact of socio-economic status on success of education across countries (OECD, 2019d). As indicated in the graph above, ESCS has less of an impact on reading performance in countries such as Macao (China), Estonia and Canada than it does in other high-achieving countries such as Singapore. The strength of the relationship varies across England, Northern Ireland and Wales and this will be discussed further in Chapter 3.

In the following analyses, some comparisons are made to Estonia and Canada as high-achieving countries with greater equity. In PISA 2018, both countries had smaller socio-economic gaps in reading (that is, the difference between the average reading scores for advantaged and disadvantaged pupils) compared with most other countries (OECD,

2019c). Estonia and Canada also significantly² out-performed England, Northern Ireland and Wales in all three subjects (Sizmur *et al.*, 2019a; Sizmur *et al.*, 2019b; Sizmur *et al.*, 2019c). Comparisons will also be drawn between England, Northern Ireland and Wales, and also the Republic of Ireland where relevant to complement the simultaneous analysis PISA 2018 additional analyses: Learning from other countries (Sizmur *et al.*, forthcoming).

² When statistical significance is reported, it indicates that the compared averages are significantly different at the 5% level.

3 How well are England, Northern Ireland and Wales supporting the performance of disadvantaged pupils?

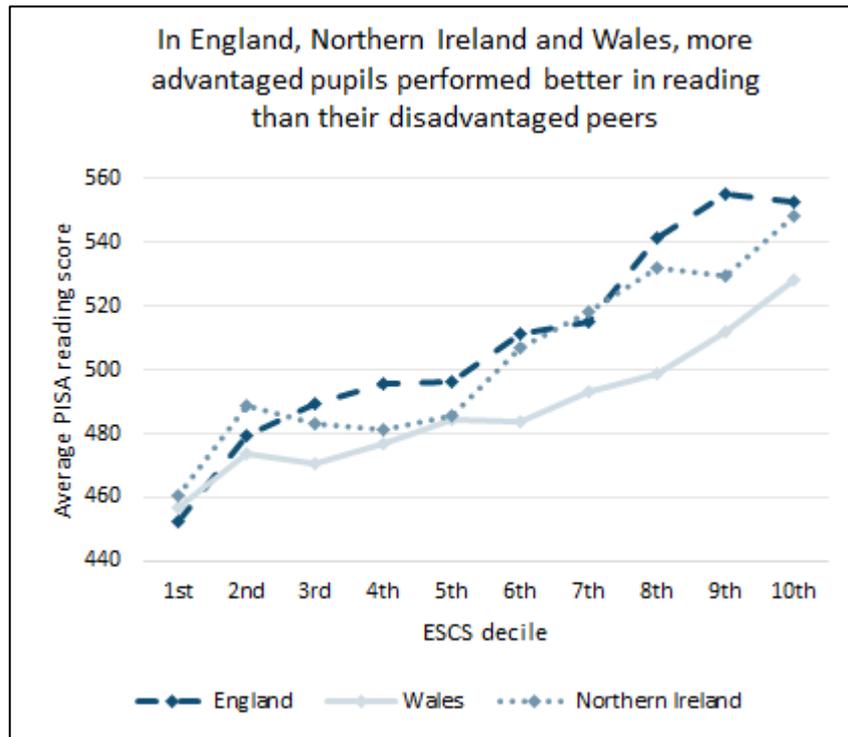
3.1 How are disadvantaged pupils in England, Northern Ireland and Wales performing compared with their peers internationally?

The gap in performance between the most and least disadvantaged pupils was significantly greater in England than in Wales for reading, maths and science

Figure 2 shows³ that, as expected, more advantaged pupils performed better in reading than their disadvantaged peers in England, Wales and Northern Ireland. Despite similar reading scores for the most disadvantaged pupils in all three countries, the gap between the most and least disadvantaged pupils was largest in England. There was a 100 score point difference in achievement of the most and least disadvantaged pupils in England, significantly larger than in Wales (71 score points). The gap of 88 score points in Northern Ireland was not significantly different from England and Wales. Advantaged pupils tend to do better in England and Northern Ireland than in Wales, with a notable difference of scores from Wales emerging by the 3rd decile in England and the 6th decile in Northern Ireland. Overall, therefore, there is greater equity in Wales than in England.

³ By splitting pupils into ten equal groups (deciles) according to their ESCS score.

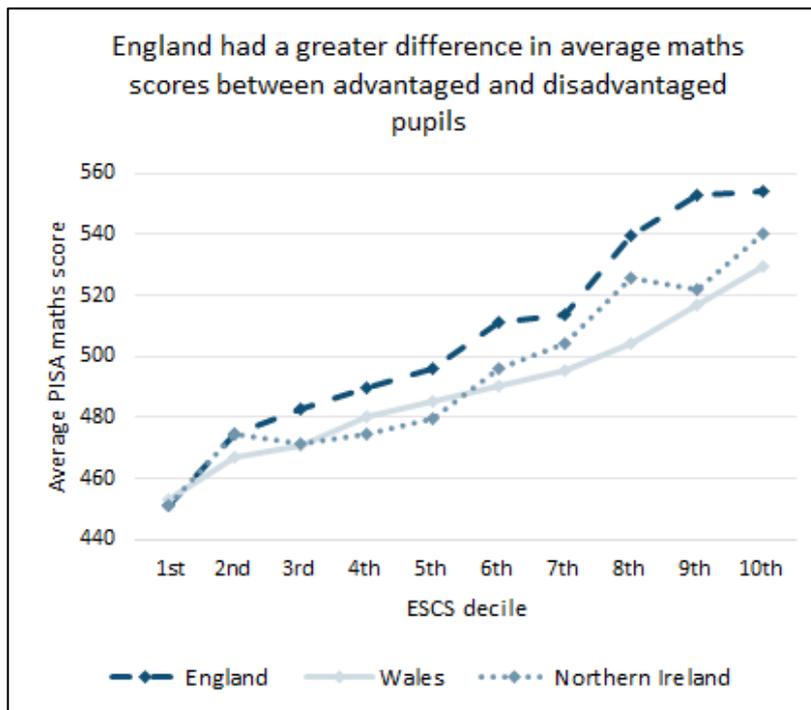
Figure 2 Average reading score at each ESCS decile in England, Northern Ireland and Wales



Source: PISA 2018 database

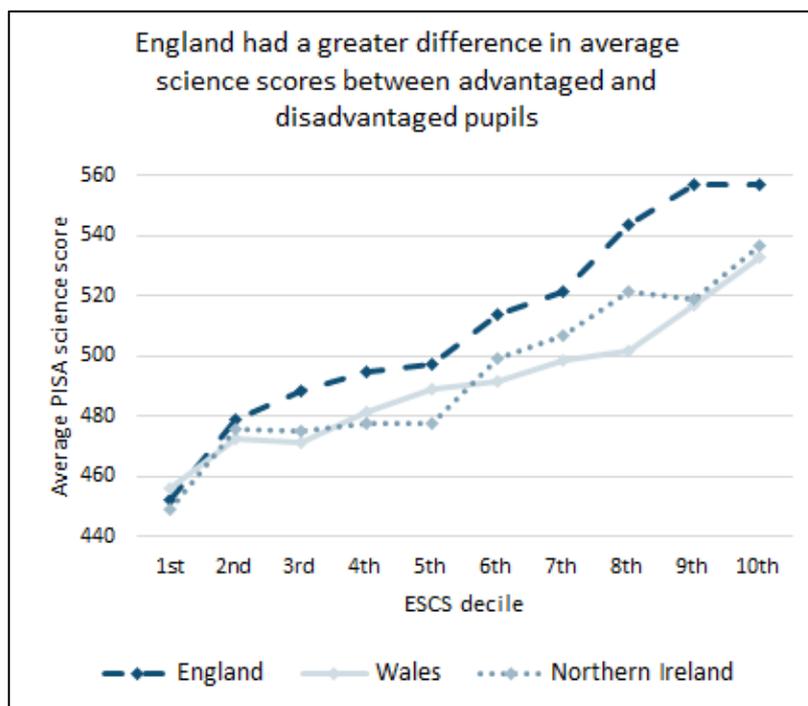
There was also greater equity in Wales compared to England in maths and science achievement, as shown in Figures 3 and 4. The differences in scores between the most and least disadvantaged pupils in England (103 score points for maths, 105 score points for science) were significantly higher than in Wales (76 score points for maths, 77 score points for science), and not significantly different from Northern Ireland (89 score points for maths, 87 score points for science).

Figure 3 Average maths score at each ESCS decile in England, Northern Ireland and Wales



Source: PISA 2018 database

Figure 4 Average science score at each ESCS decile in England, Northern Ireland and Wales



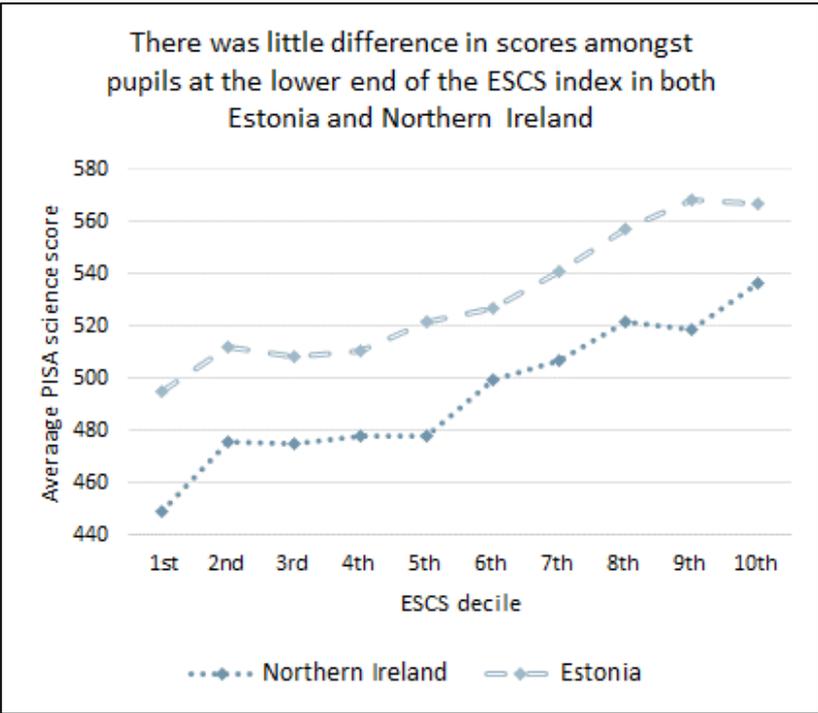
Source: PISA 2018 database

Socio-economic background had a smaller impact amongst some of the most disadvantaged pupils than for their more advantaged peers

The difference in performance between the most- and least- disadvantaged pupils, as noted above, was driven by a higher performance among the most advantaged pupils. This is illustrated in Figures 2 to 4 above, where the line is flatter at the lower levels of ESCS compared with higher levels. For example, in reading, there were smaller increases in score between the 1st and 5th deciles in all three countries (44 in England, 25 in Northern Ireland and 27 in Wales) compared with the greater increase between the 5th and 10th deciles (56 in England, 63 in Northern Ireland and 44 in Wales).

In Northern Ireland, there was very little difference in the score for pupils between the 2nd to 5th decile, which was not seen in Wales or England. This pattern was mirrored for Estonia, a high-achieving comparator country with high equity, between the 2nd and 4th deciles in all three subjects, as illustrated for science in Figure 5.

Figure 5 Average science score at each ESCS decile in Estonia and Northern Ireland



Source: PISA 2018 database

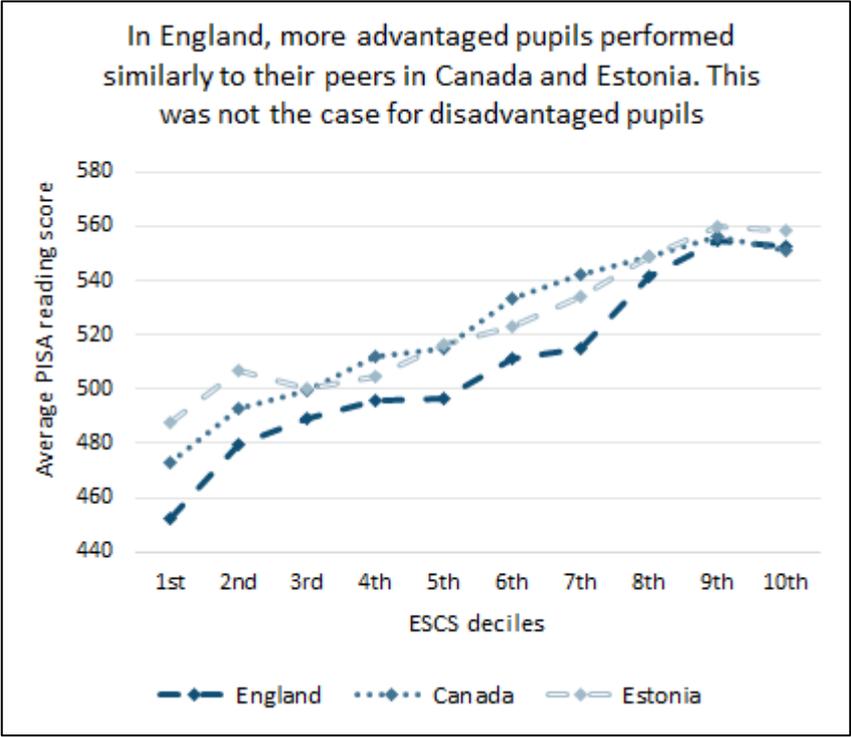
The smaller difference in scores for the most socio-economically disadvantaged pupils suggests a threshold (after the 5th decile) for which increases in socio-economic background are reflected in higher gains in performance. Prior to this threshold (below the 5th decile) there is little difference in average attainment between one pupil and a marginally more affluent peer. This indicates that socio-economic status is having different effects on these two groups of pupils in terms of attainment. It may be that below the

threshold (below the 5th decile), there is less variation (a more equal picture), as the most disadvantage pupils are performing better than expected. Or, it may be, that at each stage along the ESCS index above this threshold, non-disadvantaged pupils are performing even better than expected leading to more variation in attainment, indicated by steeper line. This effect warrants further investigation.

In England, more advantaged pupils perform similarly to their peers in Canada and Estonia

In England, pupils at the top end of the ESCS index (above the 8th decile) perform similarly to those in Estonia and Canada across all three subjects (illustrated below for reading). Pupils in England below this decile score, on average, lower than those in Canada and Estonia. Therefore, improving the performance of disadvantaged pupils would reduce the significant differences seen in reading between countries (Sizmur *et al.*, 2019b).

Figure 6 Average reading score at each ESCS decile in England, Canada and Estonia



Source: PISA 2018 database

Socio-economic background explains less of the variance in achievement in Wales and Northern Ireland compared with the OECD average

As noted in Chapter 2, to gain an accurate picture of interactions between scores and the ESCS Index, we can look at the **amount of variance in scores** which can be explained by socio-economic background, or **the strength of the effect**. This shows the extent to which the scores of pupils in each country are predicted by socio-economic background, rather than by other variables.

In common with other PISA countries, socio-economic status is associated with attainment in all three subjects and across England, Northern Ireland and Wales. For example, across the OECD, on average, 12% of the variance in reading scores can be explained by socio-economic background. The amount of variance in scores for the OECD average was more than Northern Ireland (7%) and Wales (4%) but not statistically different from England (10%) (Sizmur *et al.*, 2019a; Sizmur *et al.*, 2019b; Sizmur *et al.*, 2019c).

This indicates that there are other variables which contribute to achievement and that socio-economic background can only explain some of the differences. In Wales and Northern Ireland, socio-economic background explains less, on average, than in other countries thereby suggesting that there are other factors at play which are contributing more to the differences in achievement.

3.2 How does this compare with previous years?

The following section presents the average reading, maths and science scores for the disadvantaged pupils (those pupils amongst the bottom 33% on the ESCS index) and the rest of the sample (those amongst the top 67% on the ESCS index) across PISA cycles.

In England, Northern Ireland and Wales, the 2018 average scores for disadvantaged pupils in maths and reading were significantly higher than in previous cycles

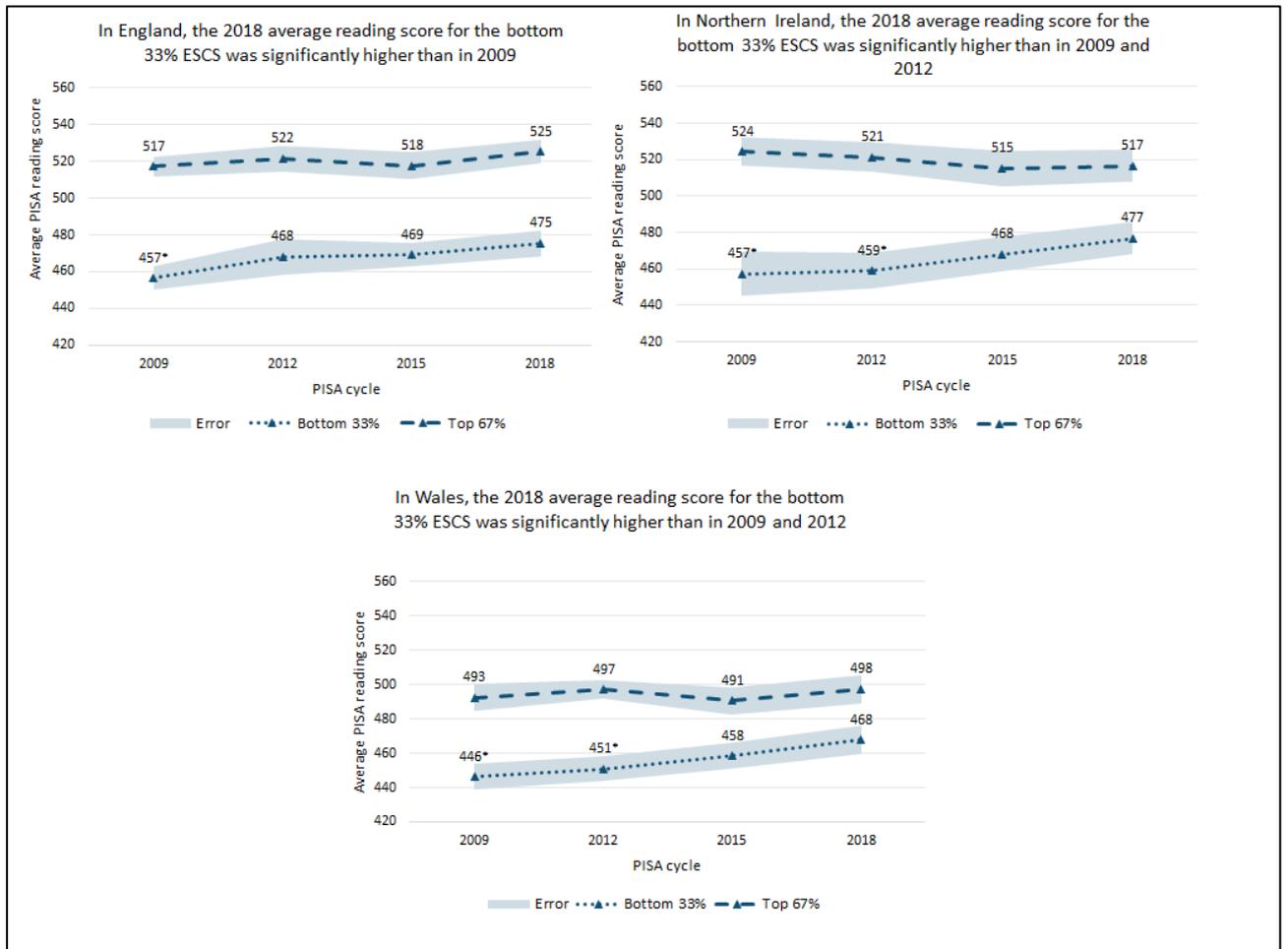
Pupils who participated in PISA 2018 had experienced some of the country-led initiatives to improve both literacy and numeracy, such as the EEF programmes in England; Count Read: Succeed in Northern Ireland and the National Literacy and Numeracy Framework in Wales. It is, therefore, encouraging that in England, Northern Ireland and Wales there was evidence of improvement amongst disadvantaged pupils since previous PISA cycles for reading and mathematics.

In England, Northern Ireland and Wales, average scores in reading and mathematics for disadvantaged pupils (bottom 33%) were significantly higher in 2018 than in at least one

previous cycle. Significant changes in England for disadvantaged pupils were seen between 2009 and 2018 for reading and maths. There was also a significant improvement in maths between 2015 and 2018 for non-disadvantaged pupils (top 67%), whilst the improvement for disadvantaged pupils was not significant.

In Northern Ireland disadvantaged pupils scored significantly higher in reading in 2018 than in 2009 and in 2012 and significantly higher in maths than in 2012. There was no significant change for non-disadvantaged pupils in Northern Ireland in 2018 compared to previous cycles. Wales followed a similar pattern in both reading and maths in that both the 2009 and 2012 scores for disadvantaged pupils had significantly improved in 2018. General performance in Wales for mathematics had improved for both groups since 2009 and 2012, as presented in Figure 8, which shows an upward trend for both the disadvantaged and non-disadvantaged pupils.

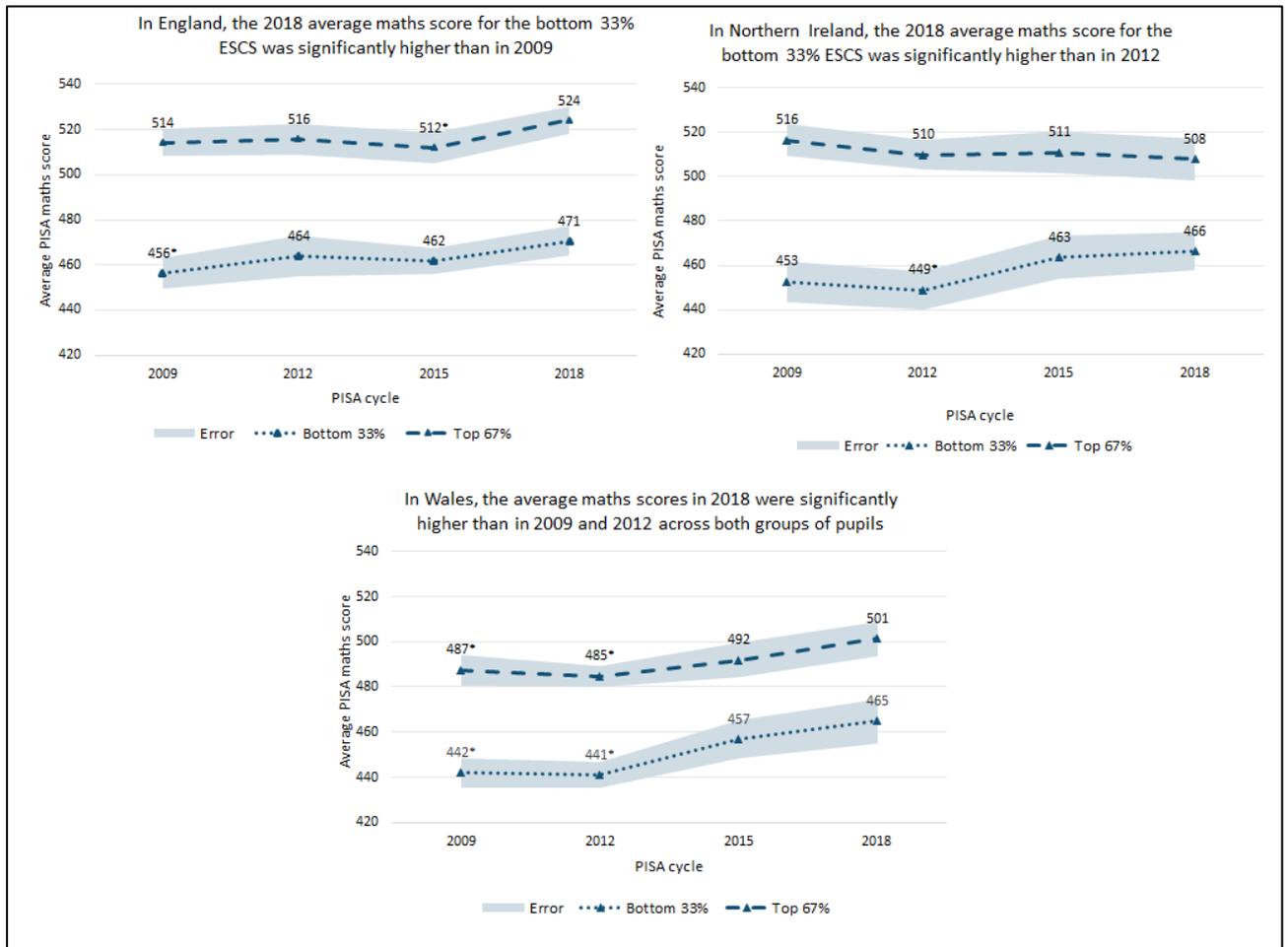
Figure 7 Average PISA reading scores for disadvantaged pupils and non-disadvantaged pupils over time in England, Northern Ireland and Wales



* Indicates a score that is significantly different from the given country's 2018 score

Source: PISA 2018 database

Figure 8 Average PISA maths scores for disadvantaged pupils and non-disadvantaged pupils over time in England, Northern Ireland and Wales



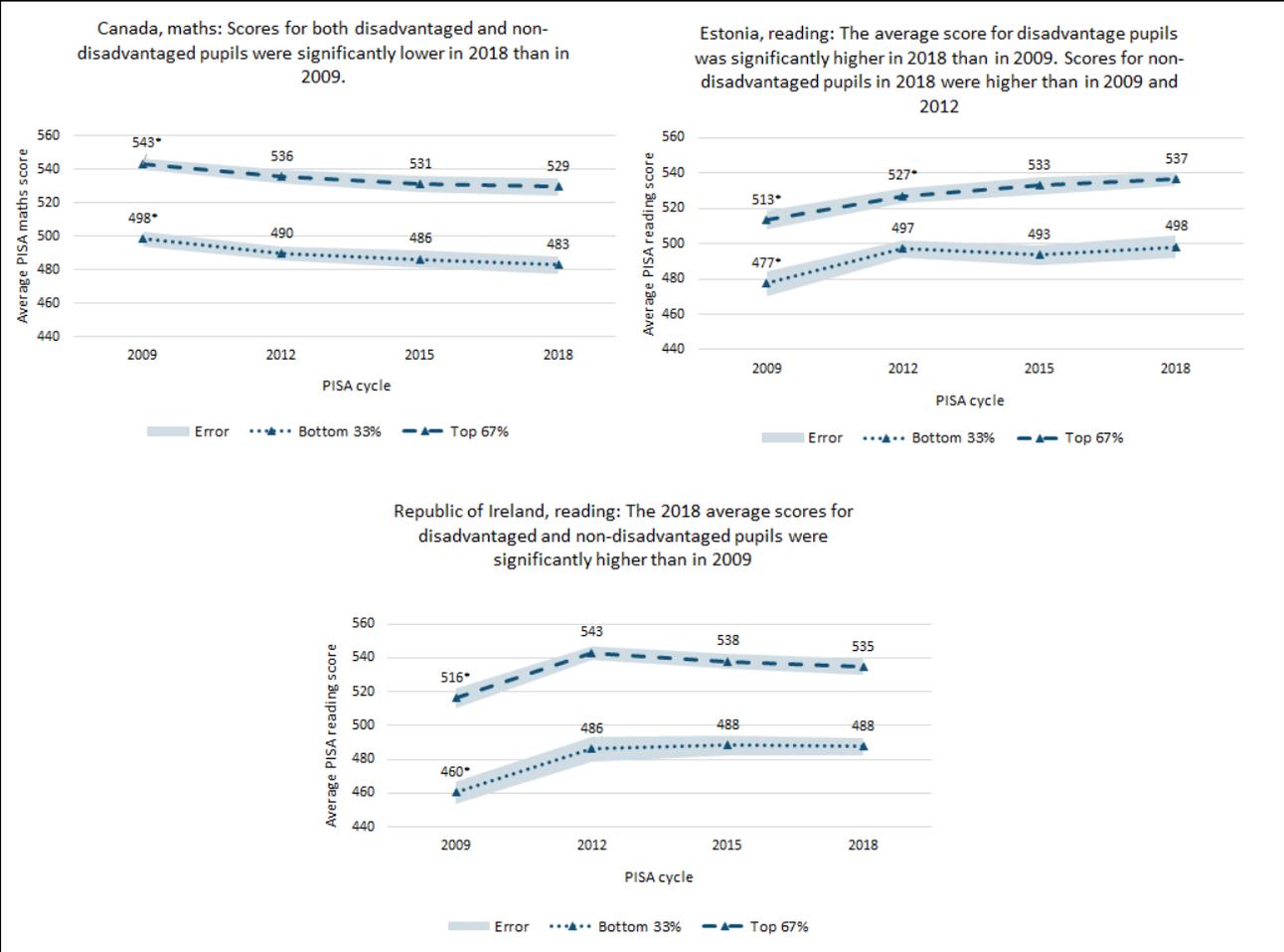
* Indicates a score that is significantly different from the given country's 2018 score

Source: PISA 2018 database

A few examples from comparator countries are included in Figure 9, where the picture is more mixed. Maths performance in Canada for both disadvantaged and non-disadvantaged pupils significantly declined between 2009 and 2018; for reading it has remained stable. Whilst there has been improvement for non-disadvantaged pupils in Estonia for maths and reading, for disadvantaged pupils it was only the 2009 average reading score that was significantly different from 2018, a result of the 2009 to 2012 rise, with scores remaining stable between 2012 and 2018. Reading performance for disadvantaged and non-disadvantaged pupils in the Republic of Ireland has followed a similar pattern for both groups, with 2009 scores that were significantly lower than in 2018. However, the Republic of Ireland's 2009 overall scores in reading and maths have often been reported as outliers (for example, McKeown *et al.*, 2019) due in part to the combination of some demographic changes, issues with the reading literacy test design, a

drop-off in pupils' engagement with PISA, and the international scaling procedure used in 2009 (Cosgrove & Cartwright, 2014).

Figure 9 A spotlight on average reading and maths scores for disadvantaged and non-disadvantaged pupils across comparator countries



* Indicates a score that is significantly different from the given country's 2018 score

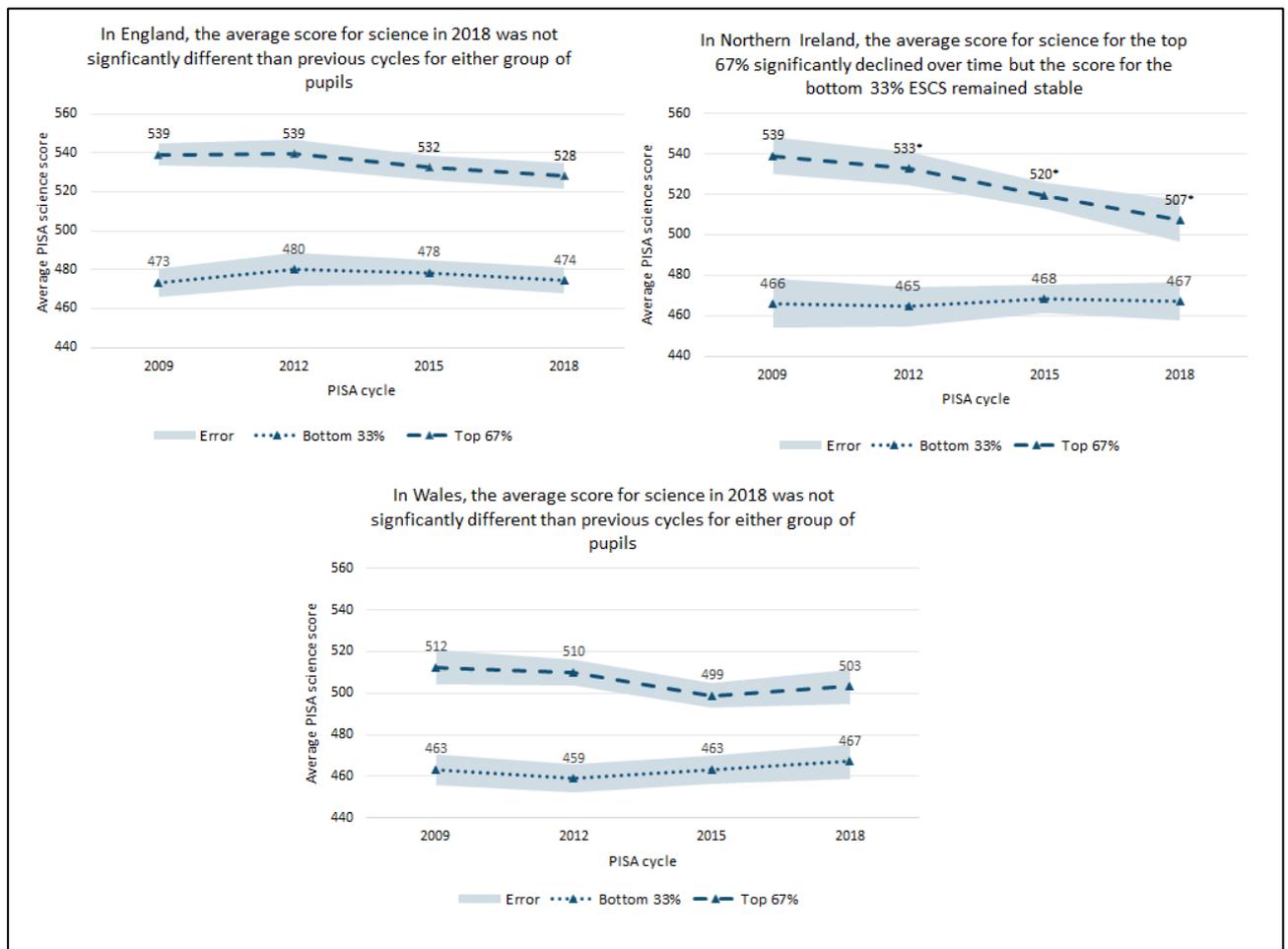
Source: PISA 2018 database

Science performance amongst disadvantaged pupils remained stable over time in England, Northern Ireland and Wales

There have been several policies introduced specifically to raise disadvantage pupils' attainment in literacy and maths (see Chapter 2). Schools may also be using policies such as Pupil premium, the Common funding scheme and the Pupil Deprivation Grant to further focus in on these areas. Therefore, it is perhaps unsurprising that whilst the most recent performance in reading and maths of disadvantaged pupils improved since previous cycles, performance in science has remained stable over this period. Figure 10 illustrates that average scores for disadvantaged pupils have not significantly changed in England,

Northern Ireland and Wales. The only significant changes seen across cycles was for non-disadvantaged pupils in Northern Ireland, that is a significant decrease in 2018 in average science score from all three previous PISA cycles. Overall science performance significantly declined in Northern Ireland over the same period (Sizmur *et al.*, 2019a) so it is somewhat encouraging that this overall pattern is not reflected in the scores for disadvantaged pupils.

Figure 10 Average PISA science scores for disadvantaged pupils and non-disadvantaged pupils over time in England, Northern Ireland and Wales



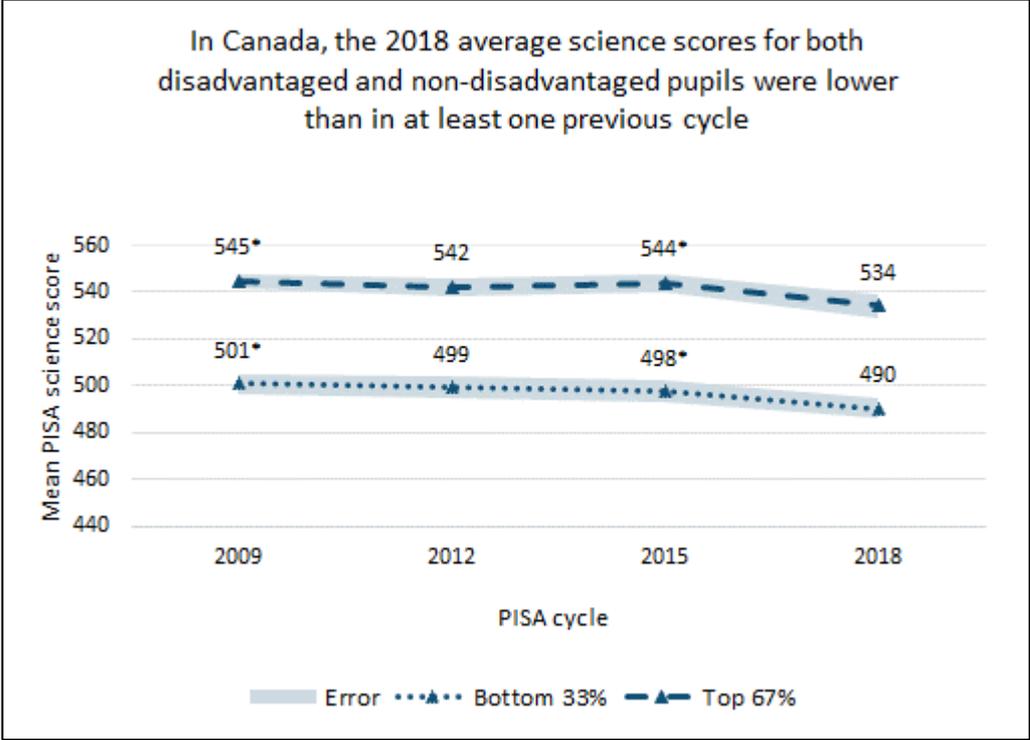
* Indicates a score that is significantly different from the given country's 2018 score

Source: PISA 2018 dataset

Whilst the 2018 science scores are not significantly different in England, Northern Ireland and Wales for disadvantaged pupils compared to previous cycles, the picture across comparator countries was different. In Canada and the Republic of Ireland the 2018 average science scores for both disadvantaged and non-disadvantaged pupils were significantly lower than the average scores from at least one previous cycle, as illustrated with Canada in Figure 11. For Estonia, the 2018 average score for disadvantaged pupils

was significantly lower than in 2012 and there was no change for non-disadvantaged pupils. This pattern across comparator countries reflects a decline in performance, on average, across OECD countries since 2012, the reason for which still warrants further investigation.

Figure 11 Average PISA science scores for disadvantaged pupils and non-disadvantaged pupils over time in Canada



* Indicates a score that is significantly different from the given country's 2018 score

Source: PISA 2018 dataset

3.3 Are there areas of reading at which disadvantaged pupils are particularly weak?

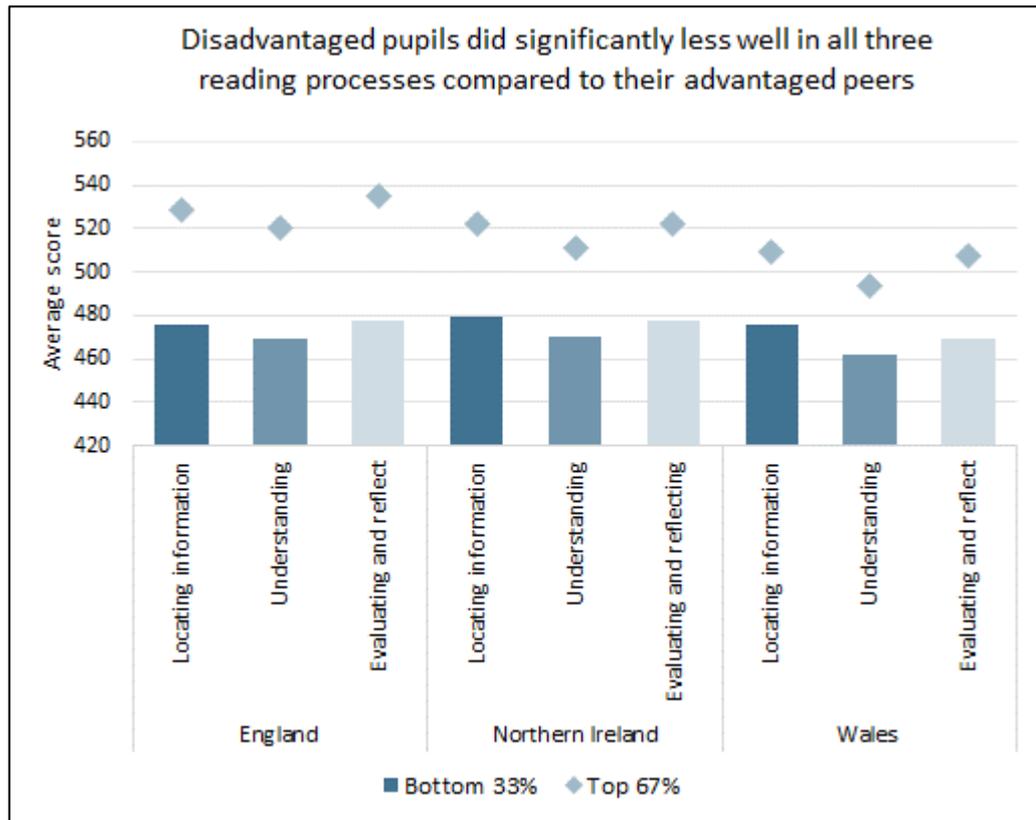
The main focus of PISA 2018 was reading, which means that we can look at performance in reading in more depth. PISA assess three reading processes which readers use when engaging with texts. These were 'locating information', 'understanding' and 'evaluating and reflecting'. Figure 12 shows the average performance in each of these processes for disadvantaged pupils (bottom 33% ESCS, bars) compared with their non-disadvantaged peers (top 67% ESCS, rhombus).

Within each country, there was a similar gap between disadvantaged pupils and their non-disadvantaged peers for all three reading processes

Non-disadvantaged pupils scored significantly higher than disadvantaged pupils on all three reading processes in England, Northern Ireland and Wales. The gap between these two groups of pupils for each reading process was similar within each country. This suggests a need for an improvement in disadvantaged pupils' performance across all three reading processes, rather than just one, in order to decrease the significant gap between disadvantaged pupils and their non-disadvantaged peers.

Scores for disadvantaged pupils were the lowest in the process of understanding for all three countries. However, that is not to say they are disproportionately weaker in this process, as generally, the overall country averages for the process understanding were lower than for the other two processes (Sizmur *et al.*, 2019a; Sizmur *et al.*, 2019b; Sizmur *et al.*, 2019c). The largest gap between disadvantaged pupils and their peers was in evaluating and reflecting, however this is unsurprising as this is the highest-level process assessed for PISA in reading.

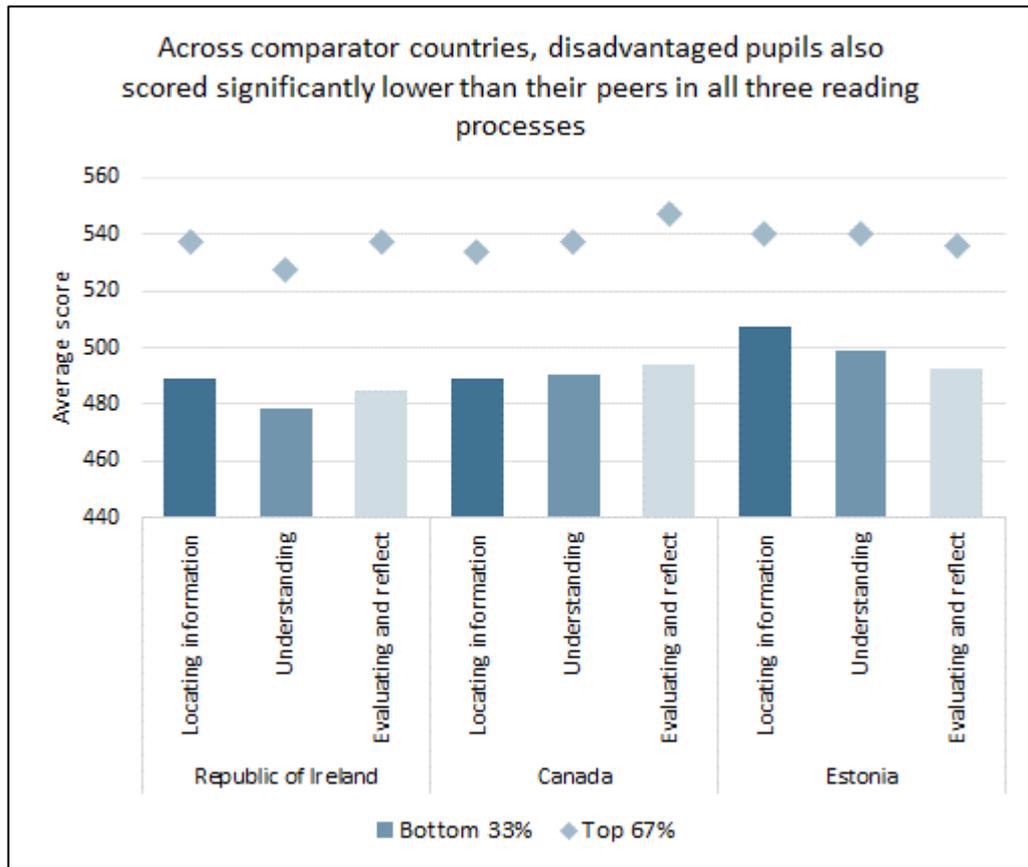
Figure 12 Disadvantaged pupils' performance in the three PISA reading processes in England, Northern Ireland and Wales



Source: PISA 2018 dataset

These findings were mirrored across Estonia, Canada and the Republic of Ireland, as shown in Figure 13. Disadvantaged pupils in Estonia appear to do better in locating information in comparison with the two other reading processes.

Figure 13 Disadvantaged pupils' performance in the three PISA reading processes in the Republic of Ireland, Canada and Estonia



Source: PISA 2018 dataset

4 Resilience

4.1 How is resilience defined?

Resilient pupils are those disadvantaged pupils who, despite the odds, are equipped with the skills they need to succeed in later life

In spite of socio-economic disadvantage, some pupils overcome barriers and attain high levels of academic proficiency. These pupils are known as ‘resilient’ pupils (OECD, 2019d). Previous research suggests that factors such as perceiving a more positive school climate, not seeing intelligence as fixed (that is, having a growth mind-set) and receiving support from parents are associated with resilience in some countries (OECD, 2019d). Further analysis from NFER has found that resilience was associated with factors such as self-confidence (Wheater *et al.*, 2016), and having a good attendance at school (Wheater *et al.*, 2016; Bradshaw *et al.*, 2018). It is worth noting that previous research into resilience has used alternative definitions of resilience than the one used for this report (for example, OECD, 2019c)⁴.

How is ‘resilience’ defined in this report?

Pupils that are among the 33% most socio-economically disadvantaged pupils in their country but are able to achieve at or above “level 3” in all three PISA domains.

This alternative definition, based on an OECD working paper (Agasisti *et al.*, 2018), provides an absolute and objective criteria of achievement (proficiency at or above Level 3). Additionally, by achieving a level 3 or above in **all** three PISA domains, resilient pupils are able to demonstrate they have acquired the skills they need to succeed in later life (Agasisti *et al.*, 2018).

⁴ For PISA 2018, OECD defined resilience as those pupils who are in the bottom quarter of the PISA index of ESCS in their own country / economy but who score in the top quarter of reading in that country / economy. Resilience has previously been defined as high-achieving in one subject rather than being high-achieving across all three.

What is Level 3 in PISA?

PISA uses proficiency levels to describe the types of skills that pupils are likely to demonstrate and the tasks that they are able to complete (OECD, 2019b). For example, pupils performing at a level 3 can integrate content and generate both basic and more advanced inferences in reading; in maths they show some ability to handle percentages, fractions and decimal numbers, and to work with proportional relationships; in science they can draw upon moderately complex content knowledge to identify or construct explanations of familiar phenomena.

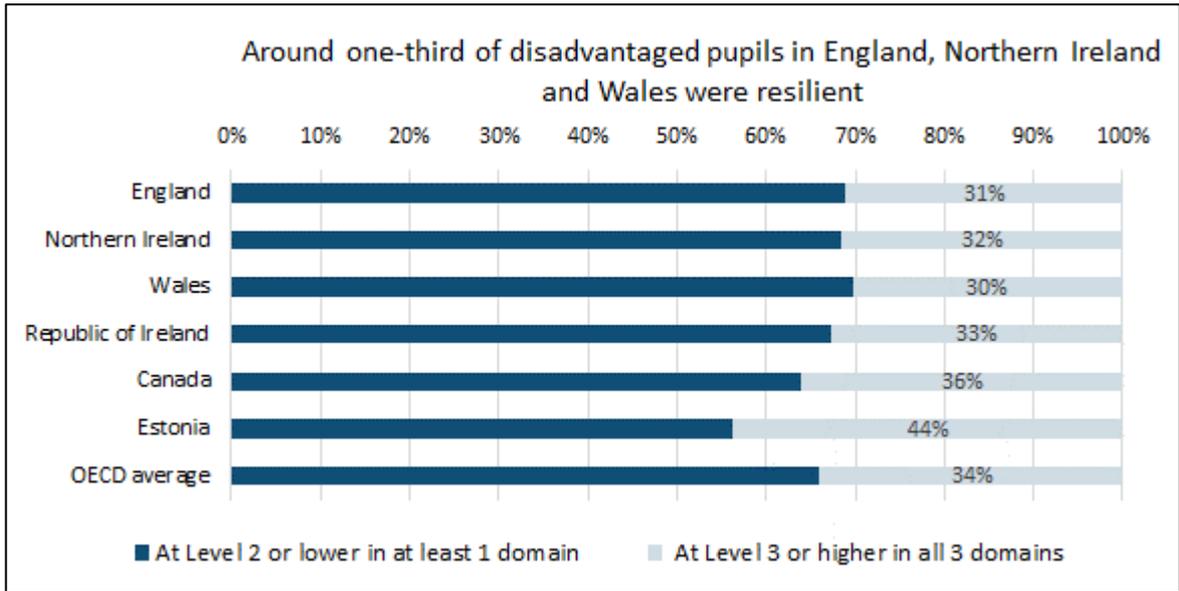
PISA measures pupils' ability to apply their knowledge to solve problems in real-world situations and is not based on specific curriculum content in participating countries. Further analysis to equate PISA scores with GCSE grades in English and mathematics is out of scope of this research. See Gambhir *et al.* (2020) or Jerrim & Shure (2017) for analysis which compares PISA results with GCSE grades.

Around a third of disadvantaged pupils in England, Northern Ireland and Wales were resilient

In England, Northern Ireland and Wales, around a third of disadvantaged pupils in PISA 2018 could be defined as resilient (as illustrated in Figure 14). This means around one-third of disadvantaged pupils achieved a level 3 or above in all three PISA domains. The OECD average for resilient pupils was similar to England, Northern Ireland and Wales (34%). If using the traditional OECD definition of resilience, the UK tends to have an above average proportion of disadvantaged pupils who are considered resilient. For example, in PISA 2018, 14% of disadvantaged pupils in the UK were considered resilient in reading (that is, they were amongst the bottom quarter on the ESCS index but scored in the top quarter of reading performance in their own country), compared to an OECD average of 11% (OECD, 2019c).

The proportions of resilient pupils in the Republic of Ireland (33%) and Canada (36%) were also similar to England, Northern Ireland and Wales. There were greater proportions of resilient pupils in Estonia (44%).

Figure 14 Proportion of resilient pupils across countries



Source: PISA 2018 dataset

The subsequent sections explore the characteristics which distinguish resilient pupils from their peers. Two types of analyses have been conducted: profiling and a multilevel logistic regression. The results from these analyses are presented below.

4.2 How do resilient pupils' attitudes differ from similarly performing pupils from more advantaged backgrounds?

Variables associated with wealth explain the main differences between disadvantaged resilient pupils and non-disadvantaged pupils who achieved level 3 or higher in all three subjects

We conducted profiling between resilient pupils (disadvantaged and high-achieving pupils) and their similarly performing peers from more advantaged backgrounds (that is pupils within the top 67% on the ESCS index who achieve a level 3 or above in all three PISA domains). Derived variables from the pupil questionnaire were included in this analysis as well as single questions which had been associated with the previous definition of resilience in the literature (the rationale behind the inclusion of variables in this analysis can be found in Appendix A).

What is profiling?

Profiling is based on bivariate correlation tests; exploring each variable's association with resilience without controlling for other variables.

Variables which were correlated above ± 0.15 are presented below.

In all three nations, variables associated with wealth were highly correlated (above ± 0.15) with resilience and therefore could be seen as differentiating between non-disadvantaged pupils who achieved a level 3 and above in all three PISA domains and resilient disadvantaged pupils. This included differences across variables such as parental occupation, possessions in the home, home educational resources and ICT resources in the home⁵. These findings were consistent across England, Northern Ireland and Wales. Whilst wealth being a distinguishing factor between the two groups is not surprising, as by definition, resilient pupils are less affluent, it is interesting that there were no differences in attitudes between the two groups, except in Northern Ireland.

In Northern Ireland, resilient pupils were less likely be confident in reading compared to their more affluent, high-achieving peers

Pupils were asked how much they agreed or disagreed with the following statements: I am a good reader; I am able to understand difficult texts; I read fluently. In Northern Ireland, resilient pupils were less likely to respond as positively to these statements than their similarly performing peers from more affluent backgrounds. This was not seen in England and Wales.

There was little difference between resilient pupils' attitudes compared with their non-disadvantaged, high-achieving peers

In the profiling analyses, the majority of the attitudinal variables did not show up as being different (that is, they did not correlate above ± 0.15) between disadvantaged pupils and their advantaged, high-achieving peers. This included how much they enjoyed/liked reading, how satisfied they were with their life and their perceived fear of failure. In terms of the school environment, there were no differences in their experiences of being bullied, their sense of belonging in school, their perception of competitiveness and cooperation at school and the perceived support from their teachers in their English lessons. Additionally

⁵ Only available for England as variable derived from the ICT questionnaire which was not administered in Wales or Northern Ireland.

there was no difference between pupils' aspirations for further education and future careers. This reinforces that it was largely socio-economic status that distinguished the two groups.

4.3 How do resilient pupils' attitudes differ from low-performing pupils from similar backgrounds?

We compared resilient pupils with their disadvantaged peers who do not perform at or above a level 3 in all three subjects.

The profiling analyses revealed that compared to their disadvantaged low-achieving peers, resilient pupils in England, Northern Ireland and Wales were **more** likely to:

- use metacognitive strategies (such as summarising texts, assessing credibility; and understanding and evaluating)
- like reading
- have self-confidence
- have high aspirations for their future careers
- have a growth mind-set (that is, seeing your intelligence as something that is not fixed)
- report they would invest a lot of effort if something was important to them

And **less** likely to:

- report finding the PISA test difficult

Some findings were not consistent across all three countries. These are presented in Table 3, where a 'yes' or a 'no' indicates where differences were found between resilient pupils and their disadvantaged peers.

Table 3 Country-specific findings from the profiling analyses

Finding	England	Northern Ireland	Wales
Resilient pupils were less likely to report finding reading difficult.	Yes	No	Yes
Resilient pupils spent more time reading for enjoyment	No	Yes	Yes
Resilient pupils reported less disruption in their English/Welsh ⁶ lessons.	No	Yes	No
Resilient pupils were less likely to report their life has meaning and purpose.	No	Yes	No
Resilient pupils were less likely to have skipped a whole day of school in the last two weeks.	No	No	Yes
Resilient pupils were more likely to report having invested effort into the PISA test.	Yes	No	No

Source: PISA 2018 dataset

It is worth noting that the profiling did not find a difference between the two groups with regards to pupils' ESCS for all three countries. This means that out of all disadvantaged pupils, the low-achieving pupils, on average, were not any more disadvantaged than their resilient peers.

In this instance, profiling was used as an exploratory technique to test each variable's association with resilience without controlling for other variables, so as to suggest a hypothesis about what may be driving resilience. The results from the regression (Section 4.4) further explore these variables by testing the associations of all variables and resilience jointly.

⁶ Pupils who took the assessment in Welsh were asked about their Welsh lessons.

Logistic regression analysis

To identify factors associated with resilience we undertook three multi-level logistic regression analyses (one for England, Northern Ireland and Wales). This predicted the likelihood of a disadvantaged pupil being classified as resilient given their individual characteristics. The variables which were included in this analysis were those which had been identified within the profiling (see section 5.3), or based on previous research around resilience, or country-level areas of interest (the rationale behind the inclusion of variables in this analysis can be found in Appendix A).

It is important to note when interpreting these findings that they demonstrate an association, but do not prove causality. Indeed, it is possible that the factors identified are a consequence, rather than a cause, of higher achievement. Nevertheless, this analysis serves to highlight areas for future attention by policymakers, practitioners and researchers.

How are profiling and multi-level logistic regression analyses different?

Profiling is based on bivariate correlation tests, exploring each variable's association with resilience without controlling for other variables. Regressions test the association of all variables and resilience jointly. This means that results will differ from those obtained in the correlations as only the unique variance explained by each variable will remain in the regression.

Profiling is more of an exploratory technique that can suggest hypotheses about what might be driving resilience and the regression results will be more robust and confirmatory. Both sets of results are informative which is why we present both.

4.4 In what circumstances do disadvantaged pupils tend to overcome barriers to perform better?

The variables associated with resilience⁷ are provided below for each country. The higher the degree of significance, identified by the number of stars, the less likely the observed result would occur due to chance. The findings are similar across countries but are not an

⁷ In this regression 'resilience' is the dependant variable. Resilience is a binary variable where 0 is disadvantaged but non-resilient pupils and 1 is resilient pupils.

exact match. This reflects what is seen generally in PISA results and specifically OECD findings around resilience⁸, which is that the strength of relationships between factors vary across countries.

In comparison to their disadvantaged, but low-achieving peers, resilient pupils in England were **more** likely to:

- use metacognitive strategies to summarise ***
- have a higher KS2 average point score ***
- use metacognitive strategies to assess credibility **
- have high expectations for their future qualifications **
- put effort into the PISA test **
- attend a school where the admission policy is based on feeder schools' recommendations **
- have a growth mind-set *

And **less** likely to:

- have found the PISA test difficult ***
- report their life has meaning, that they've found a meaning in life and they have a clear sense of what gives meaning to their life ***
- have a high perception of receiving emotional support from parents **
- attend a school where the admission policy is residence in a particular area **
- have skipped a whole day of school in the last two weeks **

*($p < 0.05$), **($p < 0.01$), ***($p < 0.001$)

Source: PISA 2018 data matched to National Pupil Database

⁸ Resilience as defined by the OECD; those pupils who are in the bottom quarter of the ESCS index in their own country but who score in the top quarter of reading in that country.

In comparison to their disadvantaged, but low-achieving peers, resilient pupils in **Northern Ireland** were **more** likely to:

- expect a higher level occupation in the future **
- use metacognitive strategies to assess credibility **
- see the importance in trying hard at school **
- be protestant *
- report they would invest a lot of effort if something was important to them *
- have a growth mind-set *

And **less** likely to:

- have found the PISA test difficult **
- regularly have positive emotions **

*($p < 0.05$), **($p < 0.01$), ***($p < 0.001$)

Source: PISA 2018 data matched to Northern Ireland School Census data

In comparison to their disadvantaged, but low-achieving peers, resilient pupils in **Wales** were **more** likely to:

- use metacognitive strategies to assess credibility ***
- use metacognitive strategies to summarise ***
- have high expectations for their future qualifications **
- expect a higher level occupation in the future **
- have a growth mind-set *
- have self-confidence *

And **less** likely to:

- have found the PISA test difficult ***
- have taken the test in Welsh ***
- have skipped a whole day of school in the last two weeks **
- regularly have positive emotions **
- attend a Welsh-medium school **
- report their life has meaning, that they've found a meaning in life and they have a clear sense of what gives meaning to their life **
- have disruptions in their English/Welsh⁹ lessons *

*($p < 0.05$), **($p < 0.01$), ***($p < 0.001$)

Source: PISA 2018 data matched to National Pupil Database

The findings above present a profile of a resilient pupil in England, Northern Ireland and Wales. The section below explores findings which are true for at least two of these countries and concludes by discussing the associations between resilience and country-specific variables.

⁹ Pupils who took the assessment in Welsh were asked about their Welsh lessons.

Resilient pupils in England, Northern Ireland and Wales were more likely to use metacognitive strategies to assess the credibility of information

Resilient pupils in England and Wales were more likely to use metacognitive strategies to summarise text

Metacognition is an awareness of how one develops an understanding of text and uses reading strategies (OECD, 2019a), or more simply, it is the means in which pupils can learn about how they learn. Questions were included in the pupil questionnaire on three aspects of metacognition: summarising; assessing credibility; and understanding and evaluating. In England, Northern Ireland and Wales, there was an association between resilience and using metacognition strategies to assess credibility. In England and Wales only, using strategies to summarise was also associated with resilience.

These findings support work by the Education Endowment Foundation to encourage the fostering of these strategies through teaching and supportive classroom practices. The Sutton-Trust-EEF Teaching and Learning Toolkit rates metacognition as a high-impact, low cost approach to improving the attainment of disadvantaged learners and the evidence suggests that use of these strategies can be worth the equivalent of an additional seven months' progress (EEF, 2018).

Resilient pupils were less likely to see intelligence as something that is fixed

Pupils were asked whether they agreed or disagreed with the statement 'Your intelligence is something about you that you cannot change very much'. Pupils with a fixed mind-set are less likely to take action to improve their skills if they are deemed unsatisfactory, even when there is an awareness that these skills will have implications for future successes (Hong *et al.*, 1999).

In England, Northern Ireland and Wales, resilient pupils were more likely to have a growth mind-set than their disadvantaged, but low-achieving peers, that is, they do not see their intelligence as something that is fixed. This means resilient pupils recognise challenges as external, understanding they can be confronted and tackled. An association between resilience and having a growth mind-set was also seen internationally (OECD, 2019d).

Resilient pupils had high aspirations for their future education and future careers

Resilient pupils had high aspirations compared with their disadvantaged, low-achieving peers. This came in the form of high expectations for their future qualifications (England and Wales) and high expectations for their future occupation (Wales and Northern Ireland).

High aspirations may act as a self-fulfilling prophecy and high aspirations may lead to high attainment, but conversely high attainment is likely to encourage pupils to have higher aspirations. Regardless of the direction of causality, by 15 years old, it would be expected that pupils have a good idea of the general level of jobs and education which are in scope for them, so any policies or interventions which focus on raising aspirations should start from an earlier age.

Resilient pupils in England and Wales were, counterintuitively, less likely to report having found meaning in life

Pupils were asked whether they agreed or disagreed with three statements: My life has clear meaning or purpose; I have discovered a satisfactory meaning in life; I have a clear sense of what gives meaning to my life (forming the eudemonia scale). Resilient pupils in England and Wales were less likely to agree with these statements, indicating they were less likely to have found meaning in their lives than their disadvantaged, low-achieving peers. PISA 2018 showed that internationally, pupils who generally scored higher in reading scored lower on the eudemonia (a sense of meaning and purpose in life) scale (OECD, 2019d), suggesting that eudemonia is negatively linked to achievement. For example, pupils who report having discovered a satisfactory meaning in life are less likely to be high-achieving. Kuhn *et al* (2021) found that aspects of wellbeing (life satisfaction, positive emotions and eudemonia) were negatively related to achievement. This finding could also be linked to other associations such as aspirations, in that pupils who haven't yet achieved all they want to achieve may not feel they have yet found a meaning in their life. More research is needed to investigate further the overall, counterintuitively, negative relationship between eudemonia and achievement so that policy makers can consider the implication of this for disadvantaged pupils.

Resilient pupils were less likely to have positive emotions in Wales and Northern Ireland

Pupils were asked how often (from never to always) they normally felt a range of emotions such as happy, proud, joyful, scared and worried. This made up the subjective wellbeing scale. Resilient pupils in Wales and Northern Ireland were less likely to respond positively to these question compared with disadvantaged pupils who were not resilient. That is resilient pupils may experience positive emotions less frequently and / or experience negative emotions more frequently. There is a well-established relationship between higher achievement and lower wellbeing in England, Northern Ireland and Wales, as reported in the simultaneous analysis on wellbeing (Kuhn *et al.*, 2021). This negative relationship might be driving these findings around resilience for Wales and Northern Ireland (and the eudemonia findings noted above) as resilient pupils, by definition, performed better than their disadvantaged, low-achieving peers. At both the pupil and

country level this appears to be a complex relationship and there may currently be a trade-off between wellbeing and achievement, further reflected in the differences between disadvantaged pupils, that is resilient and non-resilient pupils.

There was evidence of higher motivation in resilient pupils in Northern Ireland and England

Pupils responded to three statements ‘Trying hard at school will help me get a good job’; ‘Trying hard at school will help me get into a good college’; and ‘Trying hard at school is important’. In Northern Ireland, resilient pupils were more likely to see the importance in trying hard at school than their disadvantaged, low-achieving peers. Additionally, resilient pupils in England were more likely to report putting more effort into the PISA test.

Lower levels of truancy was associated with resilience in England and Wales

In England and Wales, resilient pupils were less likely to have skipped a whole day of school in the last two weeks, supporting previous findings (Wheater *et al.*, 2016). A lower level of truancy was not associated with resilience in Northern Ireland, and it is worth noting there was little difference in levels of truancy as reported by pupils compared with England and Wales.

There may be a variety of reasons why pupils skip school (OECD, 2019d) including caring responsibilities, lack of engagement, sickness or a fear of being bullied and so identifying these reasons is an important first step in supporting socio-economically disadvantaged pupils.

Exploratory machine learning analysis of resilient pupils supports our multi-level logistic analysis

We conducted exploratory analysis using machine learning to answer questions about the characteristics of resilient and non-resilient pupils. This analysis has the advantage that many variables can be included, helping to identify characteristics and patterns which may not have been considered in the multi-level logistic regression model. The analysis supports the associations between resilience and metacognitive strategies, pupils’ future study and career aspirations and the perception of the level of difficulty of the PISA assessment. More information can be found in an NFER working paper (Andrade and Liht, forthcoming).

There was no evidence that age or gender were associated with resilience

Gender was not found to be a significant predictor of resilience, despite there being some gender differences in performance (particularly in reading) across England, Northern Ireland and Wales in PISA 2018.

Additionally, Wheeler *et al.* (2016) had previously found that age was associated with resilience when looking at performance in PISA maths, that is, disadvantaged children born in the autumn were more likely to be resilient than their peers who were born in the following summer. However, there was no evidence that age was associated with resilience in this analysis across all three countries.

Other noticeably absent associations include life-satisfaction (however, there was an association with positive emotions as detailed above) and how much pupils enjoyed/liked reading. Additionally, school type was included in the regression for Northern Ireland. Despite the selective education system in Northern Ireland, there was no association found between resilient pupils and the type of schools they attend.

Country-specific associations

Some associations were found with country-specific variables.

Prior attainment in England

This analysis included the National Pupil Database variable indicating pupils' Key Stage 2 average point score. It would be expected that, on the whole, pupils who were high performing at KS2 were also high performing by the age of 15. Therefore, it is unsurprising that having a KS2 higher average point score was associated with resilience in England as by definition, resilient pupils were high-achieving in PISA.

Welsh language

The findings from the multi-level regression model suggest resilient pupils were less likely to have taken the PISA assessment in Welsh and less likely to attend a Welsh-medium school. Of the PISA 2018 sample, a quarter of pupils in Wales attended Welsh-medium schools and of these 798 pupils, just over a half took the test in Welsh (458). Some caution, therefore, is advised in interpreting this finding due to the small numbers of disadvantaged pupils attending a Welsh-medium school / taking the assessment in Welsh when you break the sample down further.

Previous research suggests that the lower performance of Welsh-medium schools is likely to be driven by the language of assessment (Classick *et al.*, 2020), but the relationship between Welsh language and performance on PISA is complex and requires further

investigation. For instance, the length of the reading texts are often longer in Welsh than in English and in some questions the word count can be up to 25% higher. Therefore, a comparison of the time taken to read the assessments in each language could be an area for further investigation.

Religion – Northern Ireland

In Northern Ireland, protestant boys who are entitled to free school meals persistently underachieve which leads to a lack of progression to further and higher education (Burns *et al.*, 2015). For the purpose of the logistic regression, religion was collapsed into two values, protestant and non-protestants. In this analysis, protestant disadvantaged pupils were more likely to be resilient than non-protestant pupils. This goes against what might be expected based on the previous research, however, it could be explained by the performance of disadvantaged protestant girls. Whilst the interaction of religion by gender, included in the model, was not significant, nearly half of protestant disadvantaged girls in the sample were considered resilient (45%). This was a much larger proportion than protestant boys (26%), and non-protestant boys (29%) and girls (31%).

Emotional support from parents – England

It is worth further exploring the link between resilient pupils in England and parental support. Pupils were asked how much they agreed with three statements about this academic year: 'My parents support my educational efforts and achievements'; 'My parents support me when I am facing difficulties at school'; 'My parents encourage me to be confident'. The link between parental support and resilience was mixed across countries in PISA 2018 (OECD, 2019c). In some countries, significantly more resilient¹⁰ pupils were observed amongst those pupils in the top quarter of the index of parents' emotional support but in countries such as Singapore, the Republic of Ireland and across the UK there was no significant difference. Our analysis suggested that resilient pupils in England were less likely to report receiving emotional support from their parents, and, therefore, conversely disadvantaged but non-resilient pupils were more likely to report emotional support from their parents. The direction of causality cannot be inferred from this analysis so we are unable to determine if lack of parental support drives resilience. It may be that parents of resilient pupils do not feel they need to provide as much emotional support because their child is achieving well at school in comparison to a parent of a low-achieving pupil.

¹⁰ Resilience as defined by the OECD; those pupils who are in the bottom quarter of the ESCS index in their own country but who score in the top quarter of reading in that country.

5 Conclusions and recommendations

5.1 Conclusions

Social mobility and improving performance of disadvantaged groups is a priority for all parts of the UK. The impact of socio-economic background on performance in reading, maths and science is evident across England, Wales and Northern Ireland but to a varying degree. In all three countries, more affluent pupils perform, on average, better than their disadvantaged peers. Wales appears to have greater equity amongst pupils than in England, that is, there is a significantly smaller difference in the average reading, maths and science scores for the most- and least-disadvantaged pupils. Northern Ireland sits somewhere in the middle, as equity appears to be similar to both Wales and England. However, socio-economic background only explains some of the variance between attainment in all three countries, explaining more in England and the OCED, on average, than in Wales and Northern Ireland.

Disadvantaged pupils' performance in reading and maths significantly improved in 2018 from at least one previous cycle of PISA and this was found in England, Northern Ireland and Wales. This is encouraging, considering the policies in place to tackle disadvantaged pupils' underperformance in maths and reading in all three countries. Disadvantaged pupils' performance in science in the three countries has remained stable over time, whilst it has decreased in comparator countries.

Non-disadvantaged pupils significantly out-performed disadvantaged pupils in all three reading processes. In England, Northern Ireland and Wales the gaps between disadvantaged pupils and their peers was similar for each process, indicating there is not just one process in which disadvantaged pupils are disproportionately weak. Instead, disadvantaged pupils need support in raising proficiency across all three processes: locating information; understanding; evaluating and reflecting.

Disadvantaged pupils who perform better than the average, given their socio-economic background, tend to use metacognitive strategies, believe intelligence is not fixed and have high aspirations for their future education or careers. They are less likely to be truant or think that their life has meaning or purpose. In this report, these pupils are known as resilient pupils, and they make up around a third of the disadvantaged pupils in England, Northern Ireland and Wales. We conclude that disadvantaged pupils may benefit from programmes which encourage the use of metacognitive strategies and counter the belief that intelligence is fixed. Further exploration is needed to determine how and where targeted support on aspirations would be most beneficial for disadvantaged pupils.

For the most part, there were no attitudinal differences found between resilient pupils and their high-achieving, more affluent peers. For example, no differences were found between pupils' sense of belonging at school, life satisfaction or future aspirations. The exception to this was in Northern Ireland, where resilient pupils were less confident in their reading than their more affluent peers. Instead, it was mainly indicators of family poverty which distinguished these pupils. Whilst it is perhaps unsurprising that wealth indicators demonstrate the differences between resilient pupils and those who are not disadvantaged and high-achieving, it does emphasise that households need sufficient household income to enable children to develop the skills they need to succeed in later life. Policies that focus on education, while important and welcome, are not sufficient. The most effective are likely to be focused on increasing equity (European Commission/EACEA/Eurydice, 2020) aiming to level up by addressing the causes (such as low income, housing costs, limited access to good jobs (JRF, 2020)) rather than the effects. Then policies can focus holistically on early intervention to address the consequences of disadvantage (across joined up policies involving health, housing, social care, youth services etc. as well as education) and work on area-based strategies to address local/community-based issues to reduce absolute and relative poverty.

It will be especially important to ensure that there is a system of support around low-income families as the COVID-19 crisis continues, making sure that basic needs are met in the immediate term. This includes ensuring access to school, especially for young people from disadvantaged areas who do not have study space or access to digital resources at home (Sharp *et al.*, 2020).

5.2 Recommendations

Programmes that support metacognition could be beneficial for disadvantaged pupils

Although causality cannot be inferred from this analysis alone, there is a wealth of evidence and support suggesting that teaching and using metacognitive strategies can help to raise the attainment of disadvantaged pupils (EEF, 2018; Macleod *et al.*, 2015; Welsh Government, 2015). This is supported by the findings that in all three countries, where the use of metacognitive strategies was associated with resilience, in that pupils who were disadvantaged, but high-achieving, were more likely to use these strategies than low-achieving, disadvantaged pupils. Metacognitive strategies can be, and arguably should be, taught in conjunction with subject specific content that will help to cement these as transferable skills (EEF, 2018).

Work towards countering the belief that intelligence is fixed

Resilient pupils were more likely to have a growth mind-set, that is, they saw intelligence as something that can be changed. It may be that having this mind-set would encourage pupils to work harder at subjects in which they are not yet achieving or that pupils who work hard learn that your intelligence can grow. Either way, fostering the concept of a growth mind-set for disadvantaged pupils would encourage them to overcome barriers.

Investigate the connection between aspiration and resilience to identify how they are related

The findings from this analysis indicates an association between high aspiration and resilience, however it does not determine whether high aspiration is a cause or effect of resilience. Further exploration would help to determine how and where targeted support would be most beneficial for disadvantaged pupils. Given the effect of COVID-19 on economies around the world, it is important that disadvantaged pupils believe that their hard work at school could lead to rewarding opportunities in the future.

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Appendix A

Variables included in the profiling

All derived variables from the Pupil Questionnaire were included in the profiling analyses. [Chapter 16 of the PISA 2018 Technical Report](#) has more details of the derived variables.

A number of single questions were included in the profiling stage based on previous research):

- In the last two full weeks of school, how often: I <skipped> a whole school day.
- About how much time do you usually spend reading for enjoyment?
- Agree: Your intelligence is something about you that you can't change very much.

The single question 'Overall, how satisfied are you with your life as a whole these days?' was also included at this stage to complement the simultaneous analysis on wellbeing using PISA 2018 data (Kuhn *et al.*, 2021).

Variables included in the multi-level logistic regression model

Table 4 includes the variables from national data (NPD or Northern Ireland School Census data) included in the respective country's regression.

Table 4 National variables included in each multi-level logistic regression

Variable	Description
E_EVER1	England FSM 6
E_KS2_1	England KS2 APS
N_FSM_1	Northern Ireland pupil entitled to free school any year in past six years
N_RELI1	Northern Ireland religion of the pupil
RXS	Northern Ireland Religion by gender Note: Interaction between religion and gender added to the Northern Ireland regression
SCHTYPE1	Northern Ireland school type – Non-grammar Note: Grammar was included as the reference category
SCHTYPE2	Northern Ireland school type – Independent Note: Grammar was included as the reference category
LANGTE1	Language of test
W_NPD_1	Wales- Study Welsh
W_NPD_3	pupil entitled to free school any year in past six years

Table 5 includes the PISA variables included in each country’s multi-level logistic regression. These were selected for the following reasons:

1. The variables correlated highly (above 0.15) at the Profiling Stage (for example, Perception of difficulty of the PISA test; Enjoy/Like reading)
2. They acted as a control variable (for example, age; gender)

3. Previous research suggested them as an area of interest (for example, In the last two full weeks of school, how often: I <skipped> a whole school day; emotional support from parents)
4. To explore the relationship between socio-economic status and wellbeing (for example, life-satisfaction and positive emotions)

Table 5 PISA variables included in each multi-level logistic regression

Variable	Description
AGE	Age
ATTLNACT	Attitude towards school: learning activities (WLE)
BSMJ	Students expected occupational status (SEI)
CHANGE	School changes (Only available for England as variable derived from Educational Careers Questionnaire)
DISCLIMA	Disciplinary climate in test language lessons (WLE)
EFFORT1	How much effort did you put into this test?
EFFORT2	How much effort would you have invested?
EMOSUPS	Emotional support from parents
EUDMO	Eudemonia: meaning in life (WLE)
GFOFAIL	General fear of failure (WLE)
HEDRES	Home educational resources (WLE)
HISEI	Index highest parental occupational status
IMMI1	Second generation immigrant
IMMI2	First generation immigrant
JOYREAD	Enjoy/Like reading (WLE)
LANGSC1	Language spoken with their school mates for students who do not speak the test language at home
METASPAM	Meta-cognition: assess credibility
METASUM	Meta-cognition: summarising
PERCOMP	Perception of competitiveness at school (WLE)
PISADIFF	Perception of difficulty of the PISA test (WLE)

Variable	Description
RESILI1	Resilience
SC012Q1	Student admission to school: Residence in a particular area
SC012Q2	Student admission to school: Parents' endorsement of the instructional or religious philosophy of the school
SC012Q3	Student admission to school: Recommendation of feeder schools
SC012Q4	Student admission to school: Whether the student requires or is interested in a special programme
SCREAD1	Self-concept of reading: Perception of difficulty (WLE)
SCREAD2	Self-concept of reading: Perception of competence (WLE)
ST004D1	Student (Standardized) Gender
ST016Q1	Life-satisfaction
ST062Q1	In the last two full weeks of school, how often: I <skipped> a whole school day.
ST175Q1	About how much time do you usually spend reading for enjoyment?
ST184Q1	Agree: Your intelligence is something about you that you can't change very much.
ST225ALL	Highest level of studies selected
SWBP	Positive emotions
UNDREM	Meta-cognition: understanding and remembering
WORKMAST	Work mastery (WLE)

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