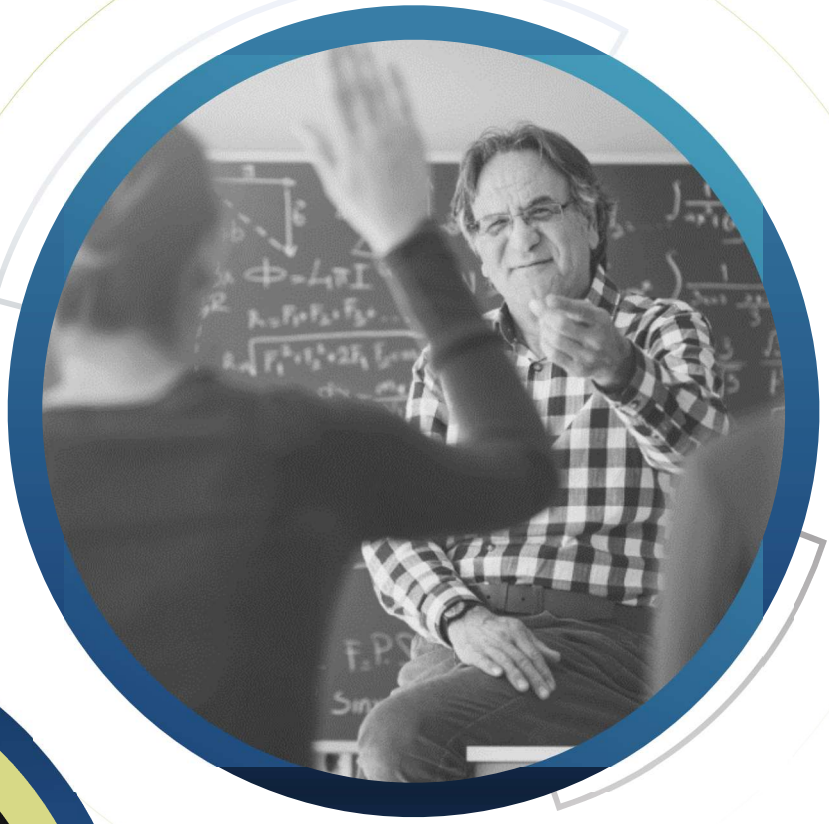

Learning to save

Teacher CPD as a cost-effective approach to improving retention

January 2022

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PRO BONO ECONOMICS

Pro Bono Economics uses economics to empower the social sector and to increase wellbeing across the UK. We combine project work for individual charities and social enterprises with policy research that can drive systemic change. Working with 400 volunteer economists, we have supported over 500 charities since our inception in 2009.

The PTI was founded by HRH The Prince of Wales in 2006. Working in partnership with the University of Cambridge it is led by teachers for teachers, and provides high quality subject-based professional development to over 6,000 teachers per annum.

Summary

The education sector in England is facing a teacher supply crunch. The number of pupils at state funded secondary schools in England is expected to grow by nearly 160,000 over the next three years. In order to maintain current teacher to pupil ratios, this would imply a need to recruit nearly 11,000 additional teachers before 2024, on top of replacing the 15,000-20,000 secondary school teachers that leave the profession each year.

This is a major source of pressure within the education system at a time when it is still stretched by having to manage Covid cases within classrooms while trying to make up for the effects of lockdowns on pupils' education.

We are unlikely to be able to recruit our way out of this crisis. On average over the last decade, recruitment shortfalls have meant 1,000 secondary school teachers are added to the shortage each year.

But reversing the decline in teacher retention would go a long way towards solving the shortfalls and easing the pressures schools and the government face. If retention rates had remained stable at 2010 levels, with only around 6% of teachers leaving per year, there would have been on average 2,800 fewer secondary school teachers lost to the profession per year over the last 5 years. A retention boost of this scale would have more than closed the recruitment shortfalls experienced over recent years. The scale of the loss has declined since 2015, but evidence of growing concerns about teacher wellbeing currently suggest that these improvements may be short-lived.

Improvements in continuing professional development (CPD) have been highlighted as one of the critical factors for keeping teachers in the profession. Analysis from the Education Policy Institute concluded that, while there is significant uncertainty, it was plausible that a 35-hour entitlement could lead to up to 12,000 additional teachers remaining in the profession each year.

Our analysis suggests that increasing the provision of high quality CPD for teachers is likely to quickly prove cost effective for the

education system, with benefits from improved retention likely to out-weigh costs within 2-3 years.

It costs the government around £24,900 to train a new teacher. Given the cost of an additional day of high quality CPD is around £150-£450, it would save government money if the additional day of CPD improved retention rates by just 0.6-1.8% pts. The incremental cost of providing 35 hours of high quality CPD (estimated by the Education Policy Institute) would be offset provided that retention rates are improved by just 2.0% pts.

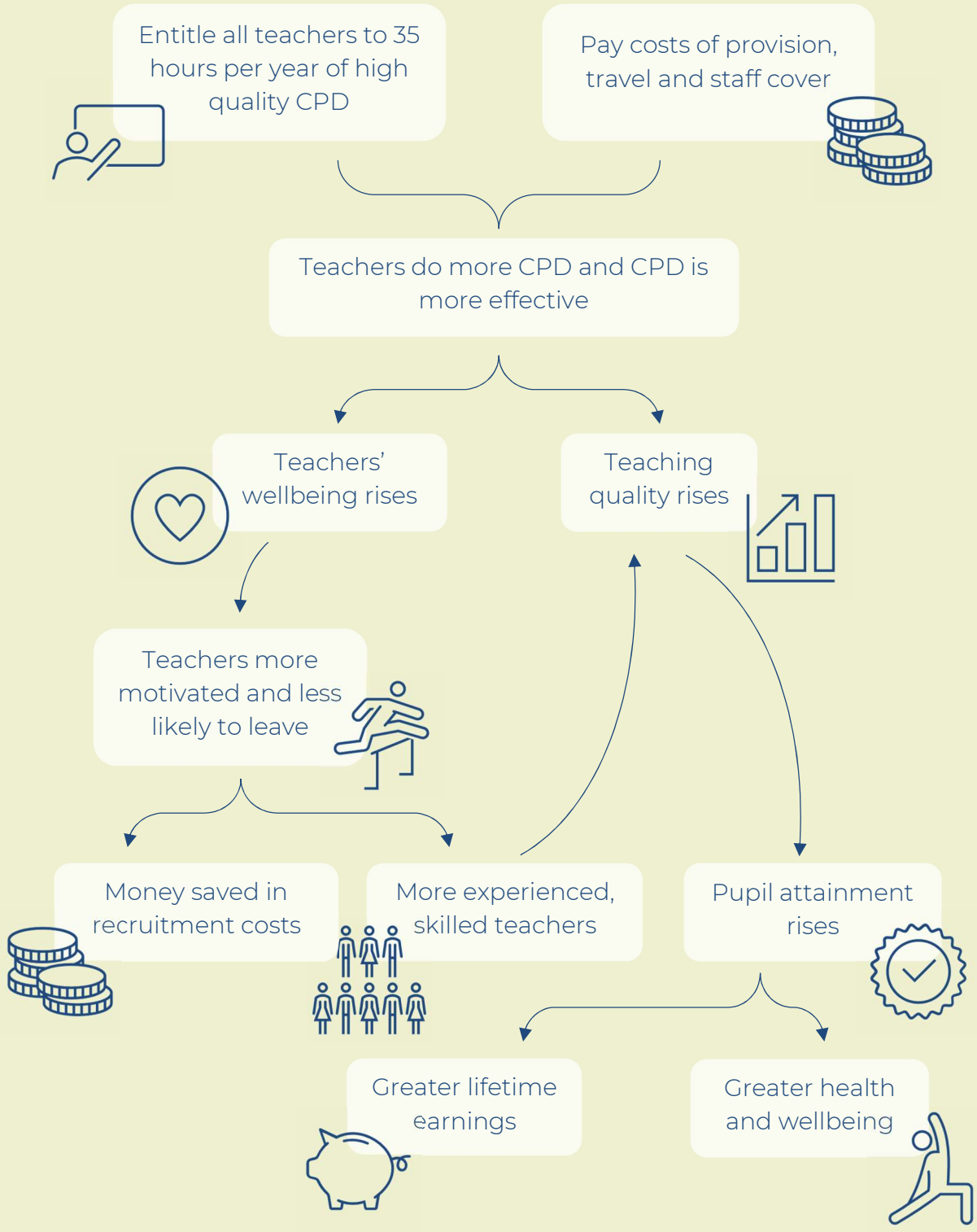
Existing evidence suggests that improvements in retention from increased CPD are likely to be at least 2% pts and possibly more. This suggests that it is plausible that savings to the government from improved staff retention will outweigh the costs from increased teacher CPD.

These benefits from improved teacher retention are in addition to the long-term economic benefits from improved quality of teaching driving up outcomes for the pupils themselves. Research from the Education Policy Institute suggested that embedding a 35-hour entitlement to CPD for teachers could increase the lifetime earnings of the average student by around £2,300. When applied across the country for a period of 10 years the benefits were estimated to be 19 times higher than the £4bn total cost of the policy.

The recently launched Early Careers Framework (ECF) – providing early career teachers with a two-year package of structured training and support – and the announcement of funding for 150,000 high-quality National Professional Qualifications (NPQs) for teachers in all state schools provide promising signs that the government is working hard to improve the provision of CPD for teachers.

However, more investment could pay dividends for the government both now and in the future. Building on recent progress to meet Wellcome's call for 35 hours of high-quality CPD for every teacher every year, is not only likely to help address the impending teacher supply crunch, but is likely to save the government money, improve the quality of teaching provided in our schools and improve outcomes for children in the longer term.

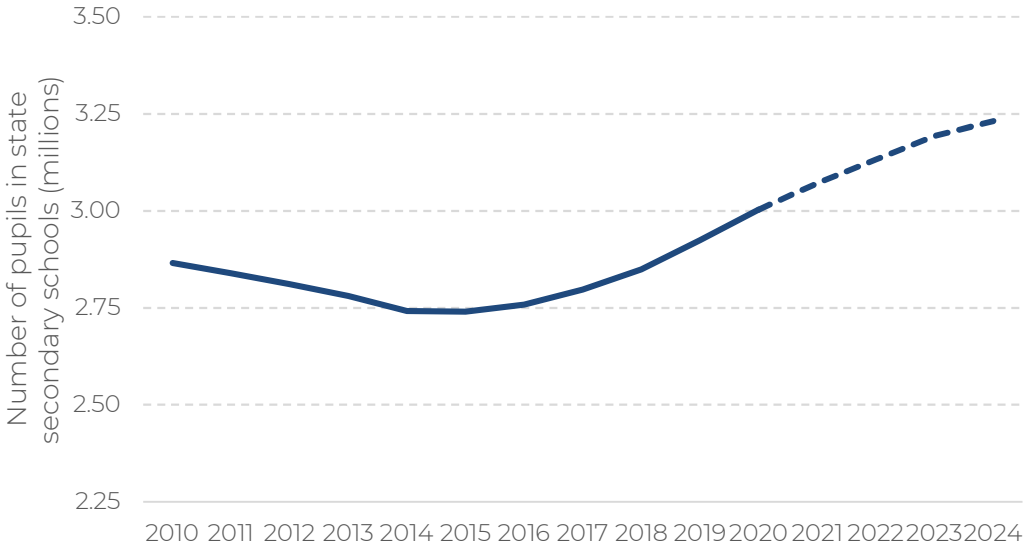
How can CPD impact outcomes?



Secondary schools in England face a shortage of teachers

Secondary schools in England are facing increasing pressure on teacher numbers. The number of pupils at state funded secondary schools in England is expected to grow by nearly 160,000 over the next three years.[1] In order to maintain current teacher to pupil ratios, this would imply a need to recruit nearly 11,000 additional teachers before 2024, on top of replacing the 15,000-20,000 secondary school teachers that leave the profession each year.[2]

Figure 1: Secondary school pupil numbers are expected to grow



Source: Department for Education (2021): *National pupil projections*

The effects of these shortages are particularly acute for schools in disadvantaged areas, where recruitment and retention are especially challenging. PISA research[3] has highlighted the scale of this problem, demonstrating that, where teacher shortages are concerned, the gap between rich and poor in the UK is greater than in many other OECD countries.

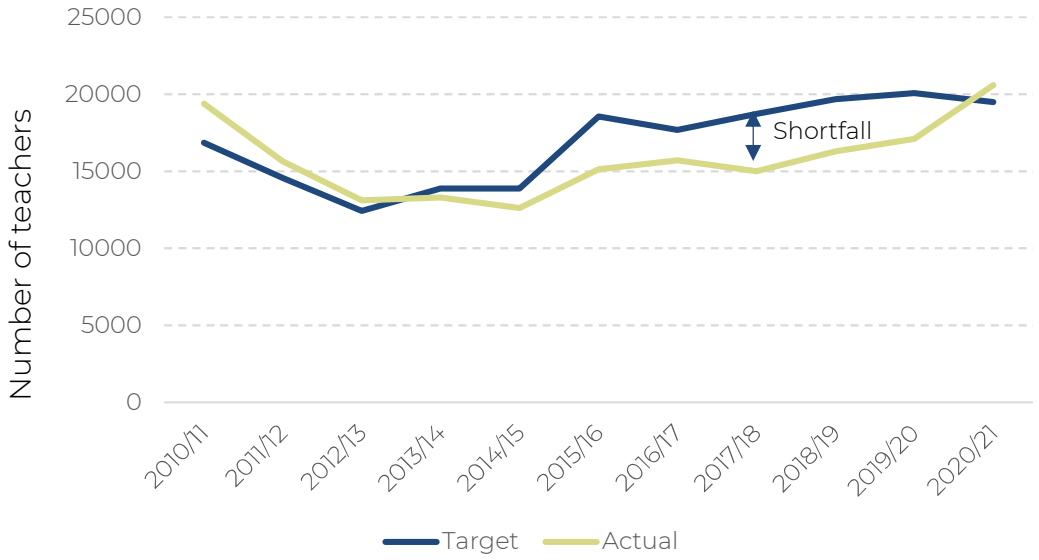
[1] Department for Education (2021): National pupil projections, accessed here: https://explore-education-statistics.service.gov.uk/find-statistics/national-pupil-projections
[2] According to statistics from Department for Education (2021): School workforce in England, there were 209,824 FTE teachers in state secondary schools in England in 2020/21, this equates to 14.6 pupils per teacher. With a forecast increase of 159,923 pupils, this is equivalent to 10,953 teachers (159,923/14.6).
[3] PISA (2018): Insights and Interpretations, p. 25.

The government needs to consider how it can significantly increase the recruitment of teachers or substantially reduce the numbers of teachers leaving the profession.

Recruiting more teachers has proven challenging

Teacher recruitment has remained stubbornly below target for much of the last decade, with the situation in shortage subjects such as physics, maths and chemistry a real concern. Recruitment shortfalls have meant there have been, on average, 1,000 new secondary school teachers missing from the profession each year, with annual shortfalls exceeding 3,500 in some years.[4]

Figure 2: Persistent shortfalls in teacher recruitment against targets



Source: ITT Census Reports

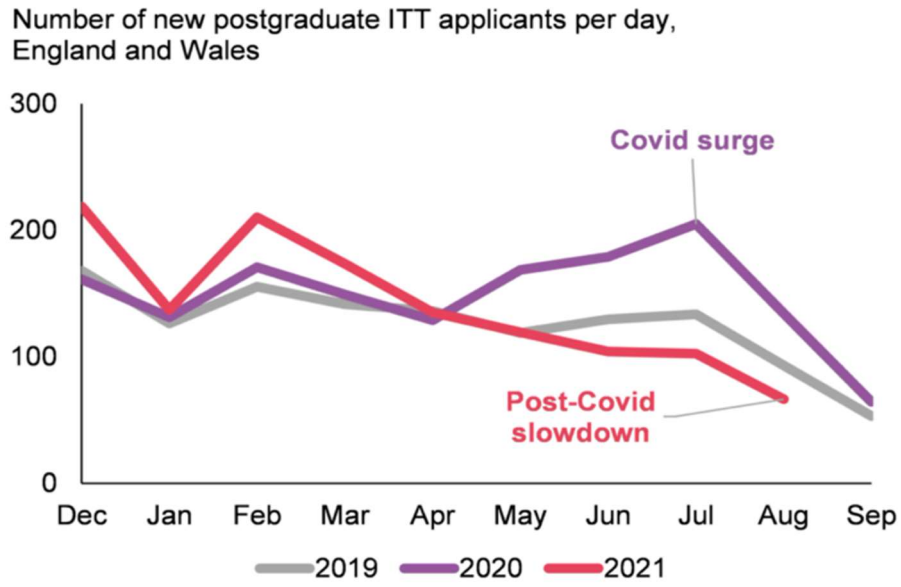
While the pandemic provided a short-term improvement in teacher recruitment, this is expected to be short-lived. Improvements in labour market opportunities as we bounce back from the economic shock, and the expected fiscal tightening – as was seen in the freeze on teacher pay levels in 2021 and delays to increasing teacher starting salaries – all make teaching a less attractive option for new recruits.[5]

Applications for teacher training are already tracking back down toward 2019 levels. The surge in applications in 2020 reversed in 2021, with applications now below 2019 levels. This suggests that actual recruitment in

[4] Shortfall of secondary teachers in England from 2010/11 to 2020/21 based on data from ITT census reports.
[5] IFS Observation (2021): *The long, long squeeze on teacher pay,* https://ifs.org.uk/publications/15552

2021/22 may well be below target once again, and that the Department for Education will not be able to rely on teacher recruitment to solve the shortages expected over the next few years.

Figure 3: The increase in applications for teacher training during the pandemic appears short-lived



Source: Tes

There is a need to focus on retaining teachers in the profession

Recruitment is only one piece of the supply puzzle. Retention is another key element, as every teacher retained means one less teacher that needs to be recruited to meet demand.

While some level of teacher loss is to be expected, as teachers retire or move in-and-out of the profession in response to major life events or to further their career, teachers have been leaving the profession at a higher rate in recent years compared to 2010.

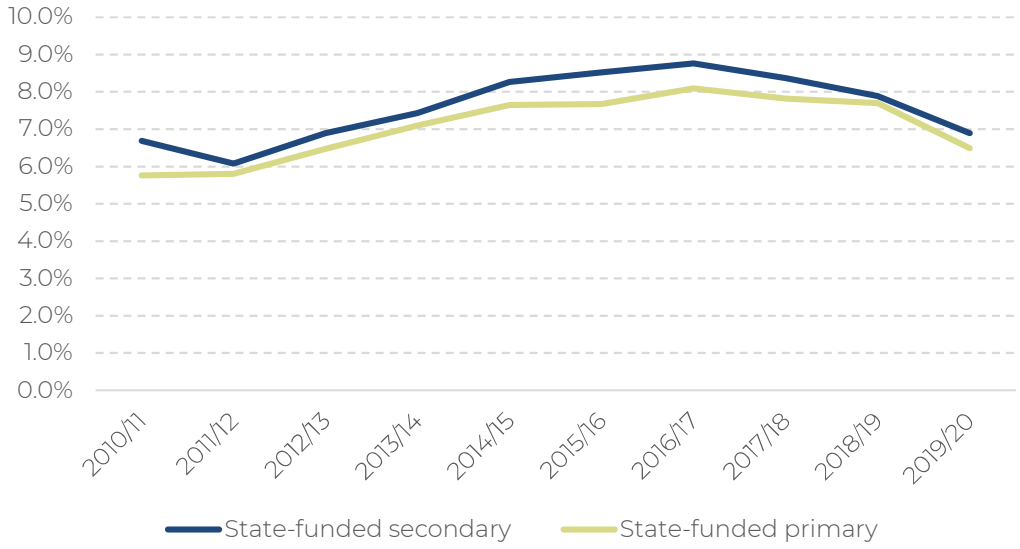
If retention rates had remained stable at 2010 levels, with only around 6% of teachers leaving per year instead of increasing to nearly 8%, there would have been on average 2,800 fewer secondary school teachers lost to the profession per year over the period 2015 to 2019. A retention boost of this scale would have more than closed the recruitment shortfalls experienced over recent years and go a long way towards addressing the overall shortages in teacher numbers.

A retention boost would be particularly welcome for schools in disadvantaged areas. These schools face higher levels of turnover, with

approximately twice the proportion of teachers leaving to teach in other schools when compared to schools in more affluent areas.[6]

Over the last two years, retention rates have trended back towards 2010 levels. With only 6.9% of teachers in state-funded secondary schools leaving the profession in 2019/20. However, there are reasons why this movement may be short-lived. In January 2021 the EPI surveyed 2,000 teachers to understand the impact of Covid-19 on their intentions to leave the profession.[7] Teachers' responses indicated that they are now almost twice as likely to leave the profession as they were before the pandemic. If this sentiment starts to feed into actual behaviour, retention rates will fall back over the coming years.

Figure 4: Percentage of qualified FTE teachers leaving teaching, 2010/11 to 2019/20



Source: Gov.UK, School workforce in England Reporting Year 2020, 'Retention of qualified teachers'.

The government has recognised the importance of improving teacher retention in tackling the need for more teachers. In 2019 it published the "Teacher recruitment and retention strategy" which sought to address challenges in school cultures, provide additional support for those early in their careers and establish alternative (non-leadership) career pathways for teachers.[8]

[6] Department for Education (2019): *Teacher recruitment and retention strategy*, p. 11.
[7] EPI policy analysis (2021): *The pandemic and teacher attrition: an exodus waiting to happen,* https://epi.org.uk/publications-and-research/the-pandemic-and-teacher-attrition-an-exodus-waiting-to-happen/
[8] Department for Education (2019): *Teacher recruitment and retention strategy*

Better professional development could help improve teacher retention

When surveyed, teachers identified improved CPD as a possible solution for improving retention.[9] Teachers in the UK undertake significantly less CPD than teachers in other countries. According to TALIS, full-time lower-secondary school teachers in England spend on average 43 hours per year on professional development.[10] This is almost 20 hours lower than the OECD average and almost 60 hours less than high-performing countries such as Singapore, where teachers are entitled to 100 hours of CPD a year.

In addition, much of the CPD presently undertaken in England is not of high quality. Data from the Wellcome CPD Challenge (commissioned to help understand how schools in England might implement a 35 hours CPD entitlement) found that only 11% of the CPD taken by the teachers prior to the Challenge met their definition of high quality. While the definition of high-quality CPD is still subject to debate, there seems little doubt that both the quantity and quality of CPD provision in England could be significantly improved.

There is increasing interest in the role of CPD in retaining staff. In May last year, the Secretary of State for Education at the time said that the government "recognise(s) that we need to go further, faster, to improve the professional training we offer teachers – at all points of their career – and ensure every teacher benefits" as he acknowledged that "too many teachers leave within the first five years of joining the profession" and that "every teacher who leaves the profession is a loss that we can ill afford".[11]

The National Association of Head Teachers' (NAHT) Improving Schools Commission recommended the need to create a learning environment for staff, where professional development and continuous learning is the norm.[12] They highlight how high-quality CPD can improve learning outcomes but also, via its impact on teacher wellbeing, boost retention. Improved retention further reinforces the improvement in learning outcomes, as more experienced teachers remain in the profession, and schools are more able to provide a stable learning environment for both pupils and teachers.

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[9] Department for Education (2018): *Factors Affecting Teacher Retention: qualitative investigation,* p. 33.
[10] OECDs (2018): *Teaching and Learning International Survey (TALIS)*
[11] Department for Education (2021): Education Secretary speech to NASUWT Annual Conference, accessed here: https://www.gov.uk/government/speeches/education-secretary-speech-to-nasuwt-annual-conference
[12] NAHT (2020), *Improving Schools A report of the Schools Improvement Commission*.

The NAHT findings are linked to evidence gathered by the Wellcome CPD Challenge and supporting analysis by the Education Policy Institute, both of which have significantly moved forward our understanding of the positive impact of CPD on both educational attainment and retention.

Analysis from the EPI concluded that, while there is significant uncertainty, it was plausible that a 35-hour entitlement could lead to up to 12,000 additional teachers remaining in the profession each year (across both secondary and primary settings).[13] An improvement in teacher retention of this scale would be sufficient to offset the increased demands faced by the sector in the near term and relieve some of the pressure to recruit.

Box 1: Case Study from the PTI

"I came across the PTI when looking for inspirational and uplifting influences to further enable our amazing students. I was looking specifically to find a way to improve staff wellbeing and also to develop a team ethos.

"Through the PTI CPD, we have been able to network and share best practice which has given us some profound insights into the diverse nature of provision needed for our young people as well as creating a sense of camaraderie between us all.

"The PTI has also offered the hugely beneficial opportunity for us to engage and collaborate with other colleagues of a similar mind-set from a great variety of schools across the country. Considering the ongoing challenges that the teaching profession has faced over the past twelve months, and which we all continue to face, it has been fundamentally important to be able to discuss teaching and learning. This has meant that colleagues have felt less isolated and that shared experiences have become less intimidating as problems shared are often halved."

- Josephine de Garis is Deputy Subject Lead of English at Queen Katharine Academy in Peterborough.

[13] The Education Policy Institute (2021), *The effects of high-quality professional development on teachers and students: A cost-benefit analysis, p. 40.*

Increasing teacher training could also save the government money

Previous studies have highlighted that improvements in teacher CPD are likely to deliver significant long-term benefits to society. EPI research from April 2021 found that a 35-hour entitlement, if well implemented, would increase lifetime earnings of the average student by around £2,300.[14] When applied across the country for a period of 10 years the benefits were estimated to be 19 times higher than the £4bn total cost of the policy.

Inevitably, benefits from such increases in future income will take a long time to be realised. Students need to progress through the education system and spend a significant period in the labour market before the impacts will be felt for government through increased taxation and reduced benefit payments.

However, at an estimated cost of £24,900 for every new teacher that enters the profession, improvements in retention have the potential to generate significant savings to government far more quickly.[15]

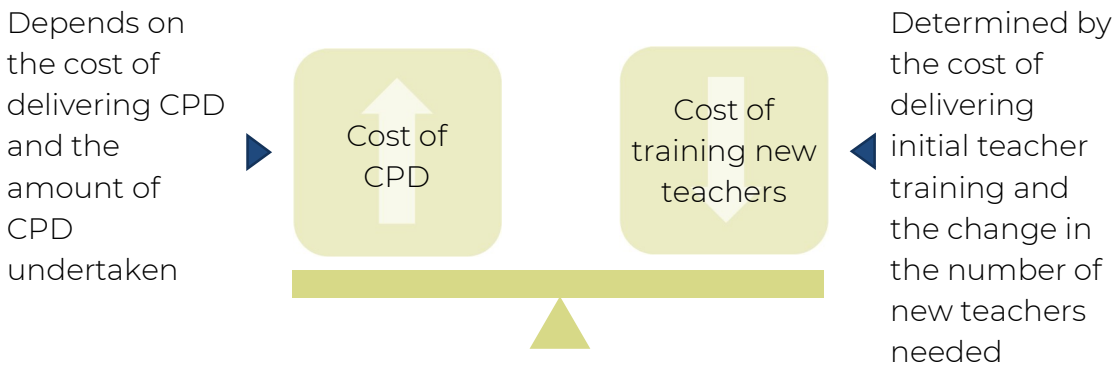
We can use this cost of training a new teacher to enter the profession to assess whether the savings in the recruitment budget due to improved CPD boosting retention are likely to offset the costs:

- A typical day of high-quality training delivered to a teacher costs in the region of £150 to £450. This means that the savings generated to government from improved teacher retention would offset these costs provided that retention rates are improved by just 0.6-1.8% pts for each additional day of high-quality CPD.

- The EPI estimate that the incremental cost of delivering 35 hours of high quality CPD per year is just £500 per teacher.[16] [17] This means that the savings generated to government from improved teacher retention would offset these costs provided that retention rates are improved by just 2.0% pts.

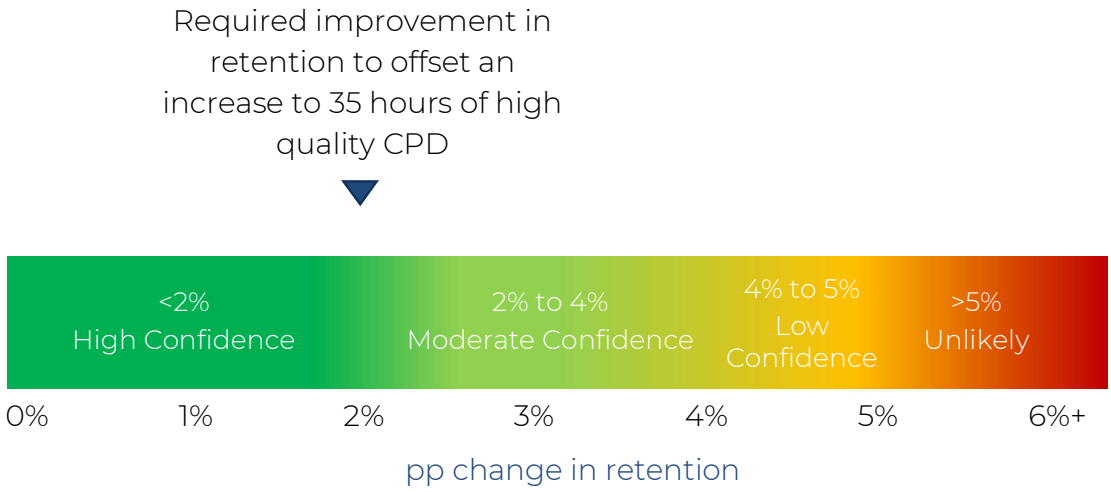
[14] Education Policy Institute (2021), p. 22.
[15] This cost includes both the direct costs to the central government (e.g. scholarships, bursaries, tuition fees and grants) and the indirect costs to schools to support newly qualified teachers (for example, via mentoring, lesson planning support, administration/paperwork costs and observations by a qualified teacher). See annex 1 for further details.
[16] Education Policy Institute (2021), *The cost of high-quality professional development for teachers in England*, p. 14.
[17] Schools already spend in the region of £3,000 per teacher per year on CPD. The EPI estimate this would need to increase to around £3,500 to meet the requirement of 35 hours high quality CPD.

Figure 5: A 2.0% pt improvement in teacher retention is required to offset the costs of meeting the 35 hours of quality CPD each year.



While the evidence on the exact impact that teacher CPD has on retention needs to be strengthened, the studies that we have identified suggest that we can have a relatively high level of confidence that it delivers improvements in retention of up to 4% pts for an additional day of high-quality CPD. Therefore, it seems likely that the savings to government from increased teacher retention could out-weigh the costs incurred.

Figure 6: It is likely that savings from improved retention offset the costs



Conclusions

Even prior to the pandemic, secondary schools in England were facing a teacher supply crunch – growing pupil numbers combined with teacher shortages will inevitably increase pressure on already over-stretched staff members. When combined with the added pressure of catching-up on the lost progress of pupils during lockdowns, we need a highly skilled, highly motivated teaching workforce more than ever.[18]

Previous evidence has demonstrated that investments in teacher CPD are likely to have significant long-term benefits through the impact on student results and subsequent earnings. However, these benefits may take a matter of decades to be realised as pupils need to progress through the education system and enter the labour market before the economic value is realised.

However, additional investment in CPD is likely to generate significant near-term improvements in teacher retention. Not only will this help to address the current teacher shortage, but it can help to reduce the costs of training new teachers.

Our analysis suggests that:

- The savings generated to government from improved teacher retention would offset the costs of an additional day of high-quality CPD provided that retention rates are improved by just 0.6-1.8% pts.
- The incremental cost of providing 35 hours of high quality CPD would be offset provided that retention rates are improved by just 2.0% pts.
- Existing evidence suggests that these improvements in retention are plausible and that savings to the government from improved staff retention are likely to outweigh the costs from increased teacher CPD.

The recently launched Early Careers Framework (ECF) – providing early career teachers with a two-year package of structured training and support – and the announcement of funding for 150,000 high-quality National Professional Qualifications (NPQs) for teachers in all

[18] Education Endowment Foundation (2021): *Best evidence on impact of Covid-19 on pupil attainment*, accessed here: https://educationendowmentfoundation.org.uk/guidance-for-teachers/covid-19-resources/best-evidence-on-impact-of-covid-19-on-pupil-attainment

state schools provide promising signs that the government is working hard to improve the provision of CPD for teachers.

However, the economic arguments for going further and expanding the provision of teacher CPD to cover Wellcome's proposal for a universal entitlement to 35 hours of high quality CPD for every teacher, every year, are compelling. Such an approach is likely to provide near term savings from the reduced need to train new teachers, whilst delivering long-term benefits in the form of better educated pupils that will provide the high-skill, flexible workforce required for the UK's economy to remain competitive in the future.

160,000

additional pupils are expected in state secondary schools in England by 2024

11,000

additional teachers will be required in state secondary schools in England by 2024 to maintain current teacher to pupil ratios

The estimated cost of recruiting and training a teacher new to the profession is

£24,900

The incremental cost of providing 35 hours of high quality CPD would be offset provided that retention rates are improved by just

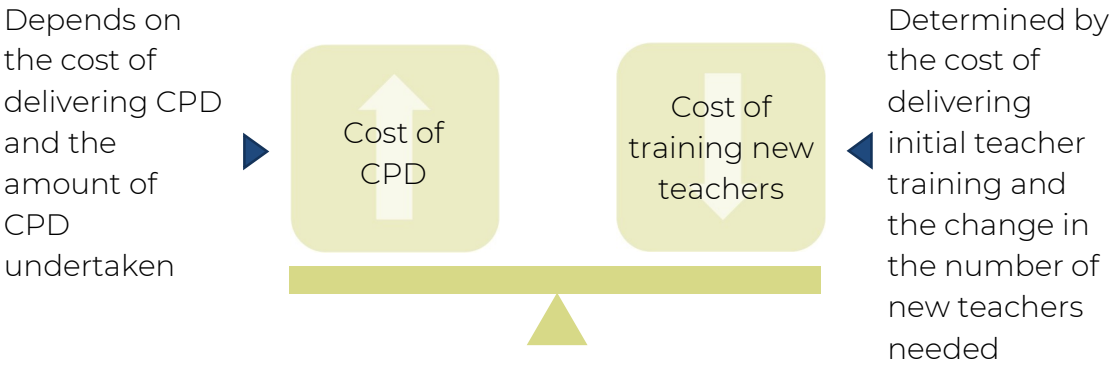
2.0% pts

Annex

How is the cost-effectiveness of CPD assessed?

To understand whether investment in CPD could plausibly be cost-effective we used scenario analysis to identify the range of the retention impacts needed for the costs of providing CPD to be recovered. The key elements of work included in this assessment are summarised in the diagram below.

Figure 7: Break-even calculation for cost-effectiveness of CPD



This break-even calculation is equivalent to solving for the change in the probability of a teacher leaving which makes the expected cost of replacement per teacher equal to the per teacher cost of CPD they undertake.[19]

Our estimates for the key data inputs needed to complete this break-even calculation are summarised below.

Estimating the cost of CPD

The costs of delivering high-quality CPD in schools includes the direct costs of providing the CPD, travel and subsistence if CPD is externally provided, and staff cover for teachers while they undertake CPD. It also includes the

[19] This can be expressed as:
Change in the probability of a teacher leaving*cost of training a new teacher = cost of CPD per teacher
$(p1-p2)*c=x$ OR $(p1-p2)=x/c$

Where:

- p1 = current probability of a teacher leaving
- p2 = probability of a teacher leaving after receiving high-quality CPD
- p1-p2 = retention boost (i.e. reduction in probability of a teacher leaving)
- c = cost of training a new teacher
- x = cost of CPD per teacher

opportunity cost of the time spent delivering or attending CPD for all staff involved.[20]

These costs are difficult to identify – direct costs may be low or not directly tracked for some types of CPD, for example if they are delivered internally by schools and implicitly included in existing staff costs. The cost of staff cover for CPD is often not reported. However, our research suggests that the total costs are likely to be in the region of £150 to £450 per teacher per day of high-quality CPD.

We collected cost information from a literature review and through interviews with external CPD providers to inform this estimate. Our findings are summarised in the table below. In this table we have assumed that the cost of staff cover per day is £150.[21]

Table 1: Data on the cost of CPD

	No. of CPD days	Est. cost (£)	Cost per day (£)	Cost per day incl. staff cover (£)
Literature				
Institute of Physics (2020): *Subjects Matter*	2.5	800	320	470
Education Endowment Foundation (2017): *Dialogic Teaching: Evaluation report and executive summary*	11	3,100	282	432
Interview with CPD providers				
Design and Technology Association and PTI (average)[22]	-	-	295	445
Average			**299**	**450**

Although the direct costs of CPD can in principle range from £0 (if the CPD and staff cover is internally provided) to more than £500, we consider that a range of costs from £150 to £450 per day is representative. The lower end of the range assumes internally provided CPD with staff cover, while the

[20] The Education Policy Institute (2021), *The effects of high-quality professional development on teachers and students: A cost-benefit analysis, p* 9 and 10.
[21] This is assumption was informed by data from the following sources: NASUWT (2021): *Supply Teachers Pay*, and Engage Education (2019): *How Much Do Supply Teachers Get Paid?*
[22] The average of the cost data provided by the Design and Technology Association and the PTI is reported due to the presence of confidential information.

upper end of the range is based on our estimate of the average costs of externally provided CPD plus the cost of cover.

Identifying the cost of training new teachers

The cost of training new teachers includes the direct costs to the central government (e.g. scholarships, bursaries, tuition fees and grants) and the indirect costs to schools to support newly qualified teachers (for example, via mentoring, lesson planning support, administration/paperwork costs and observations by a qualified teacher).

The cost of these two elements depends upon the training route the student follows and whether the teacher is training to teach in a primary or secondary setting. The latest available data on these costs is from a 2016 paper by the Institute of Fiscal Studies (IFS).[23]

The data on the cost of training new teachers is summarised in the table below. We have adjusted the cost data to reflect changes in inflation and changes in popularity of ITT routes since 2013/2014. We estimate the current weighted average cost of new teacher training in 2020 to be approximately £24,900.

[23] IFS (2016): *The Longer-Term Costs and Benefits of Different Initial Teacher Training Routes.*

Table 2: Data on the cost of ITT

ITT Routes	Type of trainee	2013/2014 training costs (£)	Training costs adjusted for inflation (£)	No. of trainees	Weighting	Weighted costs (£)
HEI-led PG	Primary	22,694	25,044	5,210	15%	3,757
HEI-led PG	Secondary	23,527	25,963	7,913	23%	5,972
HEI-led UG	Primary	19,281	21,278	4,778	14%	2,979
HEI-led UG	Secondary	-	-	185	1%	-
School Centred ITT	Primary	23,456	25,885	1,511	4%	1,035
School Centred ITT	Secondary	24,057	26,548	2,452	7%	1,858
School Direct (Salaried)	Primary	17,442	19,248	1,744	5%	962
School Direct (Salaried)	Secondary	30,265	33,399	677	2%	668
School Direct (Unsalaried)	Primary	22,367	24,683	3,380	10%	2,468
School Direct (Unsalaried)	Secondary	23,151	25,548	4,678	14%	3,577
Teach First	Primary	-	-	431	1%	-
Teach First	Secondary	36,525	40,307	1,215	4%	1,612
Total				**34,174**	**100%**	**24,889**

Note: The figures above are 2020 prices.

Sources: 1) DFE: *Initial Teacher Training Census*, 2) ONS: *CPI Index: All Items*, 3) IFS (2016): *The Longer-Term costs and Benefits of Different Initial Teacher Training Routes*.

Break-even results and scenarios

Using the data summarised above we identified the required retention boost (percentage point improvement in retention required) for a range of different scenarios (shown in the table below). These scenarios reflect key uncertainties in the data in relation to the cost per day of providing high-quality CPD, and the amount of CPD that needs to be taken for the investment to boost retention.

We provide a worked example below to demonstrate how the results are calculated.

Worked example (2 days of CPD at a cost of £250 per day)

Change in the probability of a teacher leaving =

cost of CPD per teacher/cost of training a new teacher

=£500/£24,900

=0.02 = 2pp

Table 3: Break-even scenarios – required percentage point improvement in retention for CPD to be cost-effective

Benefit of retaining a teacher	Total cost of CPD (per day)	£150	£250	£350	£450
£24,900	1 day of CPD	0.6pp	1.0pp	1.4pp	1.8pp
	2 days of CPD	1.2pp	2.0pp	2.8pp	3.6pp
	3 days of CPD	1.8pp	3.0pp	4.2pp	5.4pp

These scenarios indicate that a retention boost of between 0.6pp and 5.4pp would be required for the investment in CPD to break-even. The average retention boost required for break-even across the scenarios is 2.4pp.

The next step in our analysis, was to compare these required retention boosts against the available evidence on the plausible scale of the impact CPD could have on teacher retention.

Using the break-even results to assess for plausibility

Empirical evidence measuring the impact of CPD on teacher retention is limited. This is in part due to limitations in the data on the amount of high-quality CPD teachers currently receive.

Notwithstanding these limitations, we identified five papers that provide relevant quantitative evidence on the issue. These studies, their key results and limitations are summarised in the table below.

Table 4: Summary of studies assessing the impact of CPD on retention

Study	Research question	Findings	Limitation
Allen & Sims[24]	Does participation in the National STEM Learning Network improve science teacher retention?	The odds of a participant remaining in the profession are 160% higher than a non-participant. In addition, science departments see a 4pp reduction in the proportion of their teachers leaving the profession in the year after at least one of the department's teachers attends an NSLN course.	It is focused on science teachers. There is uncertainty in generalising the findings from a single evaluation of a single programme for secondary science teachers to all teachers in the state sector.
National College for Teaching & Leadership[25]	Is participation in the High Potential Middle Leaders programme having an impact on teacher retention?	The percentage of participants that had left the profession by the final year of the programme is 7pp lower than non-participants (15% to 8%), and 9pp lower by a year after the programme (23% to 14%). Applying the changes in the odds of leaving to the rate of secondary teachers leaving in England in 2019/20 (of 6.9%) would imply a 2.9-	Results are only statically significant at the 90% level and should therefore be treated with caution.

[24] Allen & Sims (2017): *Improving Science Teacher Retention*
[25] National College for Teaching & Leadership (2017): *High Potential Middle Leaders Secondary Programme Evaluation*

		3.3pp improvement in the rate.	
Ronfeldt and McQueen[26]	Are teachers who receive induction supports less likely to leave teaching?	Each additional element of support offered was associated with a reduction in the odds of leaving teaching of between 18% and 22%. Overall, providing extensive support reduced teacher attrition rates by between 4.1pp and 4.8pp	US study. Measures of the extent of induction support used do not differentiate between the quality of supports. The study also depends on self-reported measures of induction supports that may be prone to various reporting biases.
Papay et al.[27] (2012)	Do Boston Teacher Residency (BTR) recruits remain in the district longer than other new hires?	One year after the programme, 44% of non-BTR recruits had left teaching in the district, compared to 25% of BTR recruits.	Teacher retention in this study is defined as the proportion of teachers who stay as a teacher in the Boston district, rather than those that do not leave the profession.
Reynolds and Wang[28] (2005)	What role does Professional Development School (PDS) play in teacher retention?	10% of PDS graduates had left teaching compared to 17% of the non-PDS graduates.	The findings in this US study are based on a survey which suffers from a high non-response rate.

[26] Ronfeldt and McQueen (2017): *Does New Teacher Induction Really Improve Retention.*
[27] Papay et al. (2012): *Does an Urban Teacher Residency Increase Student Achievement? Early Evidence from Boston*
[28] Reynolds and Wang (2005): *Teacher Retention: What role does professional development school preparation play?*

The Allen and Sims (2017) report, which examines the impact of participation in National STEM Learning Network (NSLN) courses on science teacher retention, is the most useful source. This study is based on recent data and uses a quasi-experimental approach to estimate the impact of high-quality CPD for science teachers on retention in England. Hence, is both directly relevant to our analysis, and high-quality in terms of its approach.

The authors found a strong positive association between participation in an NSLN course (the majority of which take place in one day) and retention. Key results from the report are as follows:

- Participation in an NSLN course increases the odds of remaining in the teaching profession one year after the course by over 160% from 11 to 29.[29] This is equivalent to a 5pp improvement in the probability of a science teacher leaving.[30] Applying this change in odds to the 2019/20 secondary teacher leaver rate of 6.9%, would reduce the rate of teachers leaving as a result of receiving high quality CPD by 4pp[31] to 2.9%.
- Science departments see a 4pp reduction in their wastage rate (of approximately 10%) in the two years after a member of the department attends an NLSN course. This implies that there are potential spill-over effects from a single teacher undertaking CPD.

The findings of the Allen and Simms (2017) study are broadly consistent with the other studies we reviewed. Only one of the other studies can be used to create a directly comparable result. This is the National College for Teaching & Leadership (2017) report. The results of which imply an England wide impact of around 3pp. The other reports identified suggest impacts of 4pp or greater for the cohorts of teachers they analysed. However, there are reasons why these studies are either less reliable or relevant. Hence, while they add weight to the finding that CPD has a positive impact on retention, we haven't directly factored them into our assessment of plausibility.

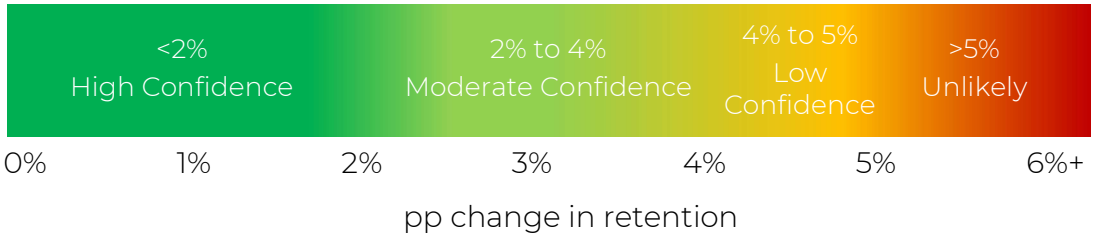
Based on our research we have concluded that a retention boost after receiving high-quality CPD of up to 5pp is plausible. However, there are significant uncertainties around this number. The effect may be overstated as these relatively small-scale studies may not be reliable indicators of the impact when high-quality CPD is rolled out across all schools and

[29] That is, the odds that a science teacher who does not participate in NSLN courses is still in the profession one year later is around 11, meaning for every one teacher that leaves, 11 do not leave. Among those who participate, the odds of remaining are 160% higher, which equates to odds of 29. This means that for every one teacher that leaves, 29 teachers do not leave.
[30] Probability of a non-participant leaving = 1 – 11/(11+1) = 8.3%. Probability of a participant leaving = 1 – 29/(29+1) = 3.3%. Improvement in probability = 8.3% - 3.3% = 5pp.
[31] Odds of a teacher leaving in 2019/20 = (1 – 6.9%)/6..9% = 13.49. Improvement in odds of 160% would the odds changed to (1 + 160%)*13.49 = 35.08. This change in odds would reduce the probability of leaving to 2.9% (100/35.08). Hence, resulting in a reduction in the probability of leaving of 6.9% - 2.9% = 4pp.

subjects.[32] Conversely, the effect may be understated, as the retention benefits (as the Allen and Simms (2017) study suggests) may last for more than 1 year and have the potential to create spill-over effects on other teachers in the same department. Neither of which are factored into our analysis.

To reflect these uncertainties, and the limited sample of studies available to base our conclusions on, we have included a sliding confidence scale in our work. If a scenario requires a retention boost of between 4 and 5pp we consider this to be plausible but with low confidence. If the boost is between 2 and 4pp or less than 2pp we consider there to be increasing levels of confidence in the plausibility of the scenario breaking-even.

Figure 8: Plausibility scale



Applying the plausibility scale to the break-even scenarios

We have applied the plausibility scale to our scenarios in the table below.

Table 5: Plausibility of break-even scenarios

Benefit of retaining a teacher	Total cost of CPD (per day)	£150	£250	£350	£450
£24,900	1 day of CPD	0.6pp	1.0pp	1.4pp	1.8pp
	2 days of CPD	1.2pp	2.0pp	2.8pp	3.6pp
	3 days of CPD	1.8pp	3.0pp	4.2pp	5.4pp

[32] The Allen and Simms (2017) study is relatively large in scale, with 25% of the Science teachers in England attended a course during the relevant period. However, there a no comparable studies which consider the impact of CPD on teachers in other subject areas.

Key

<2%	Plausible with a high degree of confidence
2% to 4%	Plausible with a moderate degree of confidence
4% to 5%	Plausible with a low degree of confidence
>=5%	Unlikely based on the evidence available currently

Based on the illustrative scenarios we considered, we think the retention boosts that would be needed for investment in CPD to break-even within 2-3 years are plausible. The average retention boost required for break-even across the scenarios is 2.4pp, which is plausible with a moderate degree of confidence. As the amount of CPD offered increases, and the cost per day rises, the confidence in our result reduces. However, these benefits are in addition to the longer-term benefits to pupils from improved educational outcomes. Once these additional benefits are taken into account, the the overall benefits in the long-term are very likely to outweigh the short-term costs.

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