EDUCATION POLICY INSTITUTE

Retrain or recruit?

Comparing routes to more specialist teachers

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Executive summary

Teacher supply in England varies widely from subject to subject, and a healthy-looking national recruitment picture can hide shortages concentrated in a few subjects. Physics and maths show the problem at its sharpest: England has too few specialist teachers in either, and the shortage falls hardest on disadvantaged schools. In the most disadvantaged schools outside London, fewer than one in five physics teachers holds a relevant degree, meaning a degree in physics or a closely related subject under the Department for Education's classification.[1] Teacher subject knowledge is associated with how much pupils learn, as measured by their attainment, so the shortage affects the quality of the physics and maths teaching pupils receive.[2]

For more than a decade the main policy lever for encouraging more teachers into shortage subjects has been the training bursary, a one-off tax-free payment made to graduates while they train, set higher in the subjects where recruitment is hardest. Physics bursaries have been raised repeatedly over that period, reaching £29,000 in 2025/26, yet physics has repeatedly fallen short of its recruitment target. Recruitment moves with the graduate labour market, improving when other graduate options are scarce and weakening when they recover, so a strong recruitment year does not on its own show that the shortage has been solved.[3] Bursaries alone have not secured a reliable supply of physics recruits.

The two routes

The government can increase the number of specialist teachers in two main ways. It can recruit more new graduates into training by raising the bursary paid to trainees in shortage subjects, or it can retrain teachers already in the profession, deepening their subject knowledge so they can teach a shortage subject such as physics. The two routes reach different groups of people. Recruitment brings in new graduates, while retraining develops teachers already working in schools.

The analysis compares the cost of these two approaches on a common measure: what each route costs to produce one additional year of specialist teaching, referred to as a "teacher-year". A teacher who teaches physics for one year provides one teacher-year, and the route that produces more teacher-years for each pound spent is the more cost-effective.

No programme in physics today trains teachers to the depth required to teach the subject at A-level. The cost of retraining is therefore modelled on a representative programme built from the recorded costs of past and present physics programmes, as a basis for comparison rather than a suggested design.

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[1] Luke Sibieta, 'Teacher Shortages in England: Analysis and Pay Options' (Education Policy Institute, March 2020).
[2] Johannes Metzler and Ludger Woessmann, 'The Impact of Teacher Subject Knowledge on Student Achievement: Evidence from Within-Teacher Within-Student Variation', *Journal of Development Economics* 99, no. 2 (2012): 486–96.
[3] Dawson McLean and Jack Worth, 'Teacher Labour Market in England Annual Report 2025' (National Foundation for Educational Research, March 2025).

What retraining involves

Three national programmes have retrained teachers of other subjects to teach physics since 2009. The Science Additional Specialism Programme (2009 to 2011) was the only one of these programmes to train teachers to A-level depth, the level at which a degree-qualified specialist can teach, reaching around 700 physics and chemistry teachers. Teacher Subject Specialism Training (2015 to 2020) reached more than 9,000 teachers across physics, maths, and languages, and Subject Knowledge for Physics Teachers, which is running now, trains physics teachers through a series of short modules. Both train to GCSE level rather than A-level. All three have been small relative to the shortage: the largest, TSST, reached only 61 per cent of its recruitment target.

Retraining is the cheaper route

Over a 5-year horizon, an additional year of specialist physics teaching costs about £5,200 through retraining, against about £41,000 through a £1,000 increase in the bursary. The horizon counts the years a teacher actually spends teaching the subject, allowing for the fact that not all stay the full period. Over 10 years the cost per year falls for both routes, because the upfront cost of training is spread across more years of teaching, and retraining's advantage over the bursary widens further. That widening reflects the mid-career teachers retraining reaches, who leave the profession at much lower rates than the early-career teachers (ECTs) a bursary attracts. ECTs have longer careers ahead of them, but a large share leave soon after qualifying, so within 10 years about 43 per cent have left teaching, against about 28 per cent of mid-career teachers.

The bursary route is expensive because any increase must be paid to every trainee, not only the additional ones it attracts: a £1,000 increase to the physics bursary would go to all 1,095 current entrants but bring in only around 32 more.

These figures are the cost to government, the money the Department for Education spends directly. A fuller accounting adds the costs that fall on schools and teachers rather than on government, namely the value of the time teachers spend training instead of teaching and the cost of covering their classes while they are away. A bursary increase is almost entirely government spending and carries no comparable school cost, whereas retraining draws on school and teacher time. Counting that time makes retraining more expensive than the government figure alone suggests, about £8,600 per teacher-year over 5 years on the wider measure of the cost to society. Retraining remains well below the bursary route on all three measures, so the conclusion does not depend on how the cost is counted. Table 1 sets out the three measures for each route: the cost to government, the cost that falls on schools and teachers, and their total, the cost to society.

Table 1: Cost per additional year of specialist teaching, by route and cost measure (2024/25 prices)

Route	Measure	After 5 years	After 10 years
Retraining a serving teacher	Cost to government	£5,200	£3,000
	Cost to schools and teachers	£3,400	£2,000
	Cost to society (total)	£8,600	£5,000
Raising the ITT bursary	Cost to government	£41,000	£24,600
	Cost to schools and teachers	£0	£0
	Cost to society (total)	£41,000	£24,600

The same budget produces more teaching

The difference also determines how much teaching a fixed budget delivers. For example, £5 million spent on retraining would produce roughly 1,700 years of specialist physics teaching over a decade, against about 600 from the same sum spent on raising the bursary, which is about 3 times as much. This assumes retraining can recruit and retain enough participants at that scale, which no programme has yet demonstrated, so it illustrates the size of the cost difference rather than projecting what a programme would deliver.

The advantage is robust to uncertainty

So far the comparison has treated a year taught by a retrained teacher as equal to a year taught by a degree specialist. In practice a retrained teacher has less subject depth and may be less effective in the classroom, so the central aim of any programme should be to make its teachers as effective as possible. The cost figures do not assume the two routes produce identical teachers, using an equivalence ratio to capture the effectiveness gap between them. The gap between the two routes' costs is wide enough that retraining remains the cheaper way to add a year of specialist teaching even if retrained teachers are somewhat less effective than degree specialists. This holds across the uncertainty in how many complete a programme and how long they stay: even crediting retrained teachers with only three-quarters of a degree specialist's effectiveness (an equivalence ratio of 0.75), retraining is the cheaper route in 100 per cent of the combinations tested.

What cost alone does not capture

Cost is just one dimension of the difference between the routes, and not every difference between them favours retraining. On the one hand, retrained teachers are mid-career professionals who bring classroom experience that early-career teachers lack, and teaching effectiveness continues to grow with experience.[4] Against this, a retrained teacher may later return to teaching their original subject, a risk that is less relevant to a new specialist, and the retraining programmes running today train only to GCSE level rather than A-level. That last point reflects how current programmes happen to be designed rather than any inherent ceiling, since SASP trained to A-level depth and programmes in other subjects do so now. Bursaries also work through the existing

[4] Matthew A. Kraft and John P. Papay, 'Can Professional Environments in Schools Promote Teacher Development? Explaining Heterogeneity in Returns to Teaching Experience', *Educational Evaluation and Policy Analysis* 36, no. 4 (2014): 476–500.

training system and can be scaled up quickly, whereas retraining depends on serving teachers volunteering and being released by their schools.

What the analysis cannot yet show

Several gaps in the evidence limit how far these results can be pushed. No programme has measured how effective retrained teachers are once they are back in the classroom, so the comparison relies on assumptions about their effectiveness rather than direct evidence. No programme has tracked whether participants continue teaching the subject afterwards, and the completion rate is unknown for one of them. The cost figures also assume programmes can fill their places and retain teachers at the scale studied, which no national programme has yet achieved. The results are best read as a cost comparison under specific assumptions, not a forecast of what a national programme would cost.

Both routes are needed

Retraining is the cheaper route, but it cannot replace graduate recruitment. The two draw on different populations: bursaries bring in new graduates, while retraining develops teachers already in schools. The physics bursary is already at £29,000, and even when recruitment is strong it adds new entrants without reaching the out-of-field teachers who already cover more than a quarter of physics teaching hours.[5] Reducing the bursary would also reduce recruitment, so putting enough specialists in front of classes will require both.

Recommendations for government

These recommendations are addressed to government, though the second could be taken forward with research organisations.

- **Fund at least one specialist-equivalent retraining programme.** If the objective is to increase the specialist workforce cost-effectively, funding a programme that trains serving teachers to A-level depth in physics would, under most plausible assumptions, produce specialist teaching more cheaply than a further bursary increase. No programme in physics currently trains to that depth, so this would mean commissioning new or expanded provision modelled on SASP, the one past programme that did. The same logic should extend to other shortage subjects, but whether a comparable depth gap and cost advantage exist depends on each subject's current provision and bursary, which this analysis does not test.
- **Build evaluation in from the start.** Any funded programme should track completion rates and link participant records to the School Workforce Census, so that it is possible to measure how many teachers complete, whether they go on to teach the target subject, and whether they later return to their original subject. These are the two largest gaps in the present evidence base, and closing them would allow a firmer comparison than the one set out here. A further question sits upstream of any programme. How many teachers

[5] Department for Education, 'School Workforce in England' (Department for Education, 2025).

would be willing to retrain, and what would encourage them, is not known, and a survey of serving teachers could establish it without waiting for a programme to be funded.

- **Add retraining alongside bursaries rather than in place of them.** At their current scale, retraining programmes cannot replace graduate recruitment, and neither route alone will put a qualified specialist in front of every physics class, so a lower cost per teacher-year is not a reason to cut bursaries. The goal is the number of specialists actually teaching, not the share of a single year's recruitment target that is met. Recruitment rises and falls with the graduate labour market, so a strong recruitment year is a weak basis for cutting the bursary, and even a year that clears the target leaves untouched the existing out-of-field teachers a recruitment rebound does not reach. Expanding retraining also depends on removing the barriers to participation, in particular the cost of releasing teachers from timetabled lessons, which evidence from current provision identifies as the main constraint on completion.

Introduction

The government's "opportunity mission" places teacher quality at the centre of its education reform programme. The *Every Child Achieving and Thriving* white paper set out plans to recruit 6,500 additional teachers.[6] Delivering on that commitment requires closing the shortage of degree-qualified teachers in subjects such as physics and maths, where long-term recruitment deficits have left many schools reliant on non-specialists. In the most disadvantaged schools outside London, fewer than one in five physics teachers holds a relevant degree.[7]

In this report we compare two of the main policy levers available to the government to create more specialist teachers in shortage STEM subjects: bursaries and retraining. The initial teacher training (ITT) bursary pays graduates to train as teachers in shortage subjects. Subject-specific retraining develops the subject knowledge of teachers already in the profession so they can teach a shortage subject. Both have previously been funded at national scale but only the bursaries are currently in place. This report asks which route produces more additional years of specialist teaching for a given budget. It estimates the cost per additional specialist teacher under each route over 5- to 10-year time horizons, and identifies the conditions under which each is more cost-effective.

We use the term "retraining" because it matches the names of the English programmes (SASP, TSST, SKPT) and current policy language. The international research literature describes the same population as "out-of-field" teachers — a framing that emphasises the support they need rather than what they lack.[8]

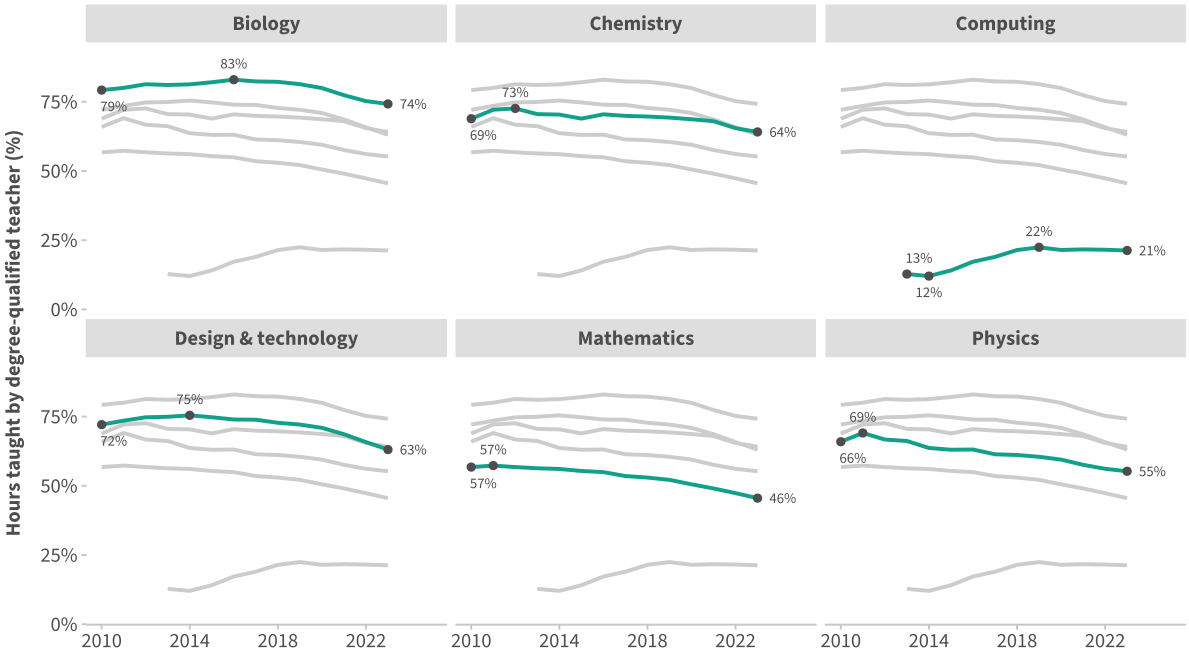
The analysis focuses on physics because it has the largest and most persistent recruitment shortfall and the most complete cost data. It draws on cost and participation data from three national retraining programmes that have provided physics-specific training: the Science Additional Specialism Programme (SASP, 2009-2011), Teacher Subject Specialism Training (TSST, 2015-2020), and Subject Knowledge for Physics Teachers (SKPT, 2022-present). It compares the cost of retraining with the cost of increasing the physics ITT bursary, which is the government's primary tool for attracting additional specialist trainees.[9]

[6] Department for Education, 'Every Child Achieving and Thriving', White paper (Department for Education, 2026).
[7] Sibieta, 'Teacher Shortages in England'.
[8] Dieuwerke Rutgers et al., 'Understanding Subject Specific Professional Development for Out-of-Field Teachers: An Evidence Review' (Sheffield Hallam University, April 2025).
[9] Dawson McLean, Sarah Tang, and Jack Worth, 'The Impact of Training Bursaries on Teacher Recruitment and Retention: An Evaluation of Impact and Value for Money' (National Foundation for Educational Research, November 2023).

The specialist teacher shortage

England's secondary schools do not have enough degree-qualified teachers to cover the STEM curriculum, and the problem is getting worse. In physics, 55 per cent of teaching hours are delivered by a teacher with a relevant degree and, in maths, only 46 per cent.[10][11] Both have declined over the past decade, and the pattern extends across STEM subjects. Figure 1 shows a fall in every subject except computing, whose series begins only in 2013. Physics and maths have each lost more than 10 percentage points since 2010/11, and design and technology 9 points. That decline matters because there is evidence that teacher subject knowledge is positively associated with pupil achievement.[12] The shortage therefore represents not just a staffing challenge but a drag on the quality of STEM education that pupils receive.

Figure 1: Percentage of teaching hours delivered by a degree-qualified teacher, by STEM subject, 2010/11 to 2023/24. Each panel highlights one subject; grey lines show the other subjects for context.

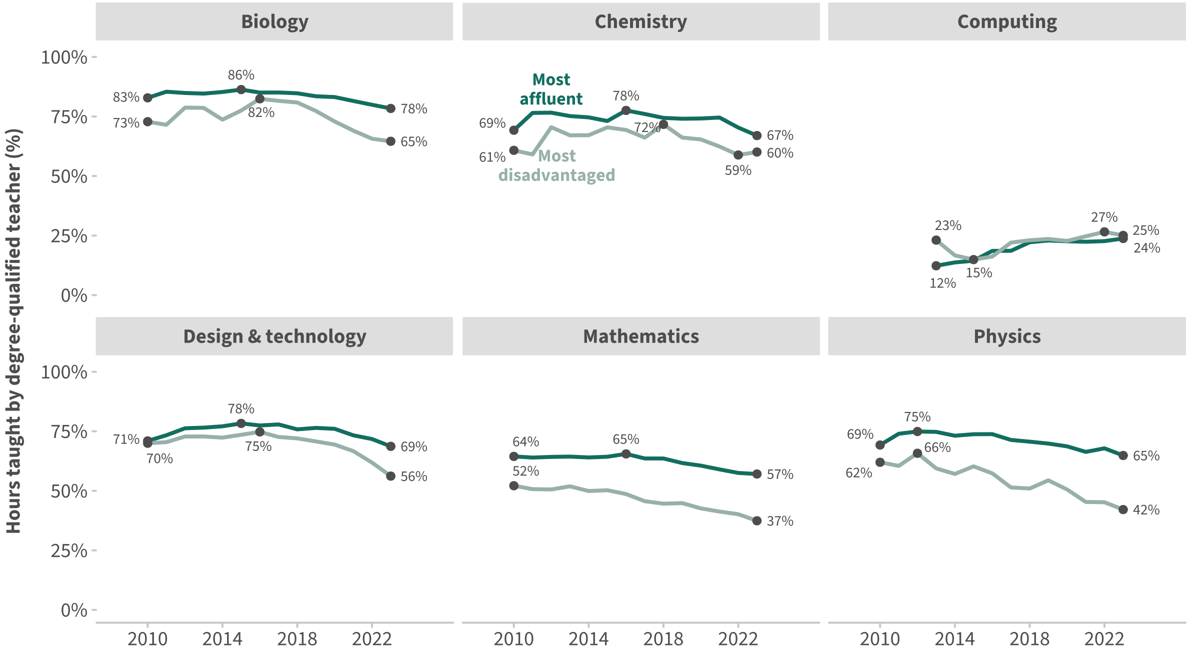


The shortage also falls unevenly across schools. Figure 2 compares the proportion of specialist teaching hours in the most affluent and most disadvantaged quintiles of secondary schools (by free school meals eligibility). Disadvantaged schools now trail affluent schools by 23 percentage points in physics and 20 points in maths, and both gaps have widened since 2010/11, when they stood at 7 and 12 points respectively.[13] Pupils in the most disadvantaged schools are therefore the

[10] Joana Cardim Dias, Eva Jiménez, and James Zuccollo, 'Closing the Workforce Quality Gap: Experience, Expertise and Stability in Disadvantaged Schools' (Education Policy Institute, April 2025).
[11] These figures use a stricter measure than DfE's own headline statistic. DfE's School Workforce in England publication reports teaching hours delivered by a teacher with a relevant post-A-level qualification, which also counts qualifications below full degree level. This report instead measures teachers with a relevant degree for consistency with the disadvantage-gap comparison below, which DfE does not publish.
[12] Metzler and Woessmann, 'The Impact of Teacher Subject Knowledge on Student Achievement'.
[13] Cardim Dias, Jiménez, and Zuccollo, 'Closing the Workforce Quality Gap'.

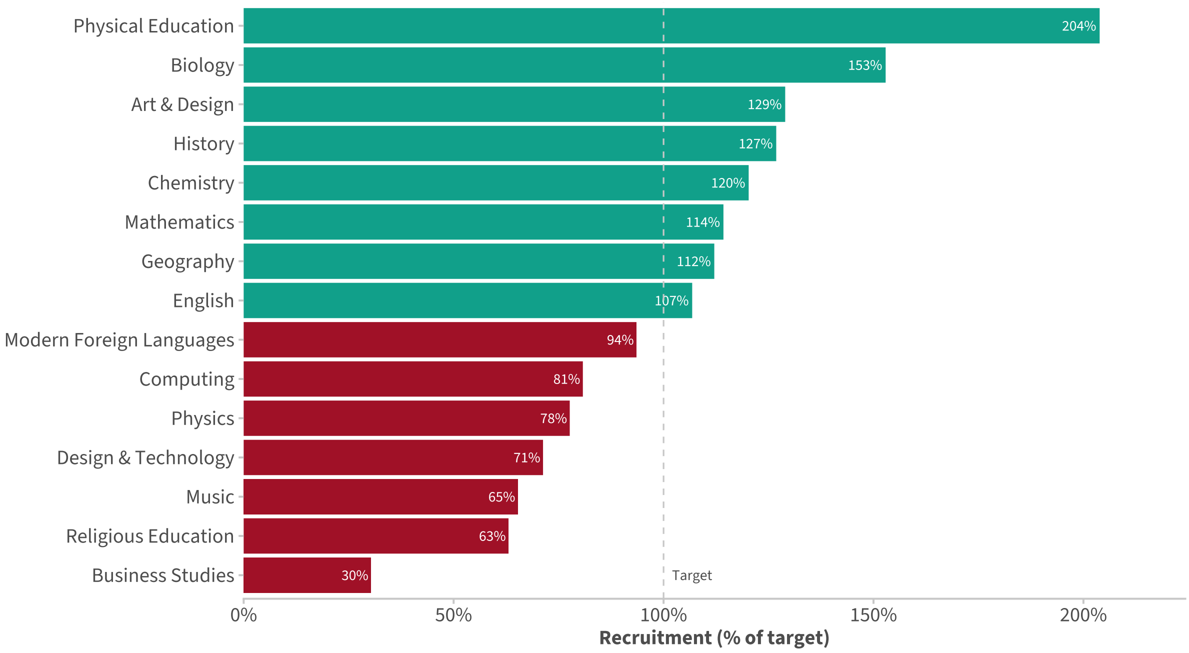
least likely to be taught by a degree-qualified specialist, compounding the educational inequalities they already face.

Figure 2: Percentage of teaching hours delivered by a degree-qualified teacher in the most affluent and most disadvantaged school quintiles, by STEM subject, 2010/11 to 2023/24.



ITT recruitment has not been able to close this gap. In 2025/26, physics recruited 1,095 postgraduate entrants against a target of 1,410, reaching 78 per cent of target (Figure 3). Computing, design and technology, music, and religious education also fell short. Meanwhile, other subjects overrecruited substantially: physical education reached 204 per cent of target, biology 153 per cent, and history 127 per cent. The pattern of simultaneous shortage and surplus suggests that the problem is not a general lack of people entering teaching but a persistent failure to attract enough graduates in specific high-demand subjects.

Figure 3: ITT recruitment as a percentage of target by subject, 2025/26 (PG entrants).

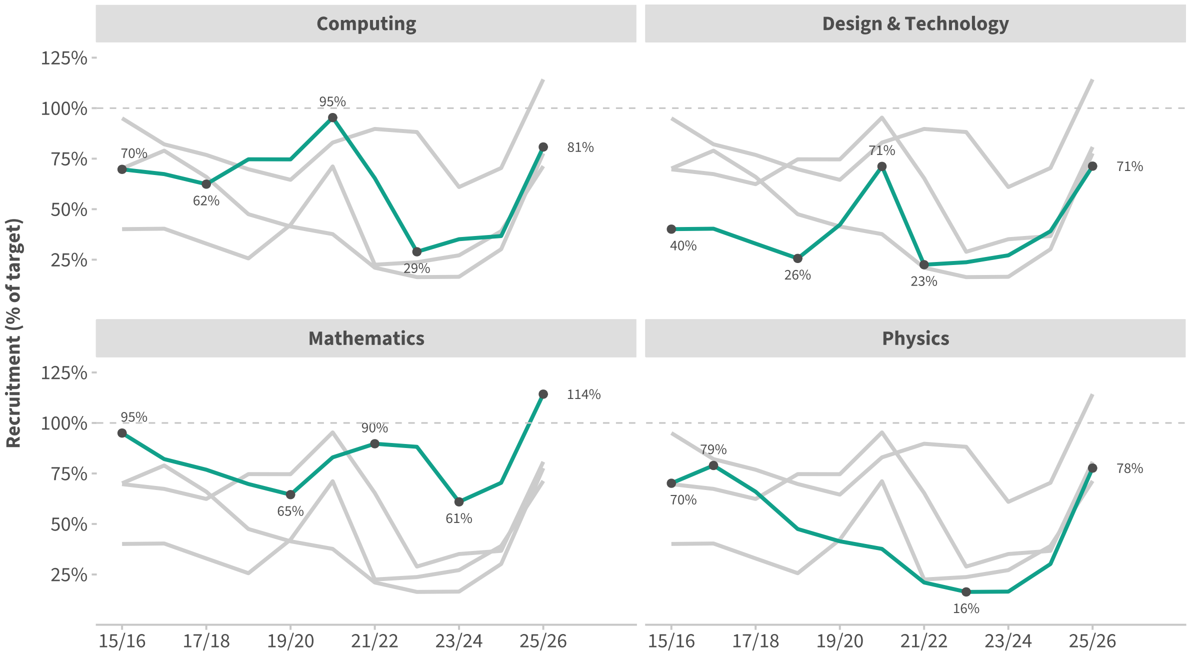


These shortfalls have persisted for well over a decade, as Figure 4 shows for the four main STEM shortage subjects from 2015/16 to 2025/26. Some of the movement in the physics series reflects changes in the target rather than in recruitment: the physics target nearly doubled between 2020/21 and 2021/22, from 1,336 to 2,530, so the steep fall in the share of target met that year came from the higher target while postgraduate entrants held roughly flat at around 500. Entrants stayed between about 430 and 680 through to 2024/25, then rose sharply to 1,095 in 2025/26, the highest since comparable records began, lifting the share of target met to 78 per cent against a target that had itself been lowered to 1,410, down from 2,250 the year before.[14] Much of that increase reflected international recruitment rather than more UK graduates entering training. DfE extended bursary and scholarship eligibility to overseas physics and languages trainees from 2023/24, and by 2025/26 around two-thirds of physics entrants came from overseas, 58 per cent from outside the UK and European Economic Area (EEA) and a further 5 per cent from the EEA.[15] DfE then paused that eligibility from 7 May 2026, citing improved recruitment,[16] so the durability of the rise is uncertain, as is how many overseas-trained entrants go on to teach in English state-funded schools. Recruitment also tends to strengthen when the graduate labour market weakens and to fall back when it recovers, so a part of any improvement is cyclical rather than a durable response to policy.[17] The target itself has continued to fall, cut by a further 43 per cent to 810 for 2026/27 as the department's workforce model registered improved recruitment and retention.[18] That makes the share of target met a weak gauge of the shortage, because a lower target reflects

[14] Department for Education, 'Postgraduate Initial Teacher Training Targets, Academic Year 2025/26' (Department for Education, 2025).
[15] Department for Education, 'Initial Teacher Training Census, Academic Year 2025/26' (Department for Education, 2025); Department for Education, 'Initial Teacher Training Bursaries Funding Manual: 2023 to 2024 Academic Year', 2023.
[16] Schools Week, 'Ministers Scrap Physics and Languages Bursaries for Foreign Trainees' (Schools Week, 11 May, 2026).
[17] McLean and Worth, 'Teacher Labour Market in England Annual Report 2025'.
[18] Department for Education, 'Teacher Demand and Postgraduate Trainee Need, Academic Year 2026/27' (Department for Education, 2026).

projected demand for new trainees rather than the stock of out-of-field teaching already in schools. Maths makes the same point from the other side: it recruited above its reduced target in 2025/26, yet around a fifth of maths teaching is still delivered by non-specialists. Computing and design and technology show persistent shortfalls of their own. A decade of underrecruitment has compounded into the workforce gap documented above, which raises the question of whether alternative approaches to increasing the supply of specialist teachers could complement bursaries.

Figure 4: ITT recruitment as a percentage of target for STEM shortage subjects, 2015/16 to 2025/26 (PG entrants). Each panel highlights one subject; grey lines show the other subjects for context.



The evidence on the link between teacher subject knowledge and pupil outcomes, previewed above, is limited but suggestive. Direct estimation in England is not currently feasible because administrative data do not link individual teachers to the pupils they teach at classroom level. The strongest available estimate comes from Metzler and Woessmann, who exploited within-teacher, within-student variation across subjects in Peruvian data.[19] By comparing the same teacher's effectiveness in subjects where they had stronger versus weaker knowledge, they controlled for both student ability and general teaching skill, and found that a one standard deviation increase in teacher subject knowledge raised maths achievement by about 10 per cent of a standard deviation. The Peruvian context differs from England in important ways, so the magnitude may not transfer directly, but the finding suggests that the shortfalls documented above may have implications for what pupils learn.

[19] Metzler and Woessmann, 'The Impact of Teacher Subject Knowledge on Student Achievement'.

Two routes to more specialist teachers

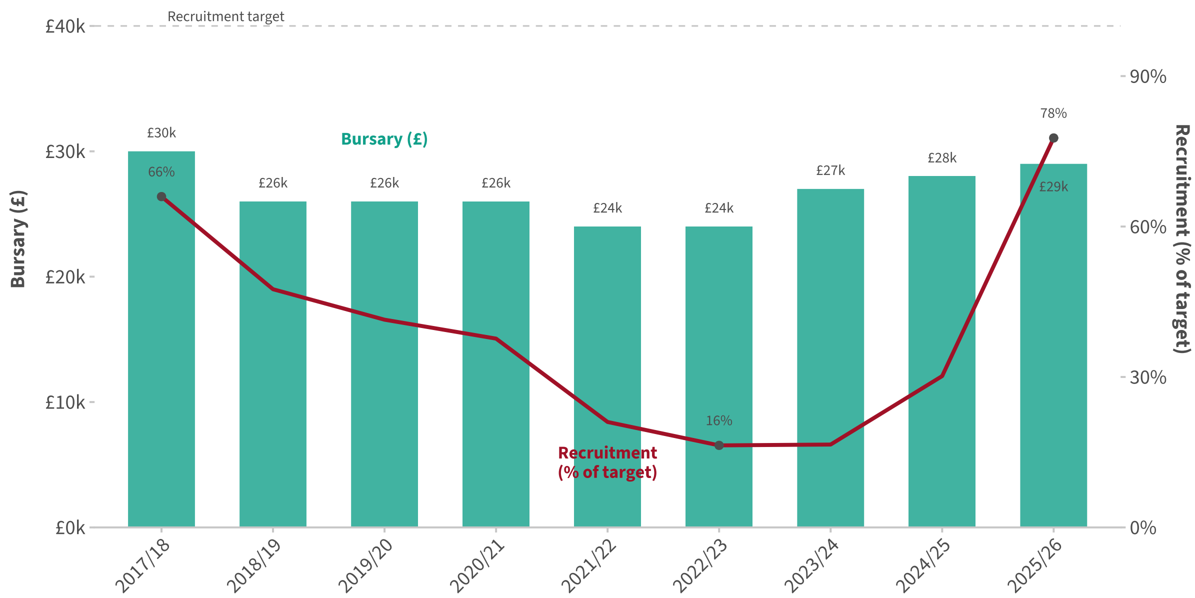
This report compares two ways to increase the number of specialist physics and maths teachers: raising ITT bursaries to recruit more trainees, and retraining existing teachers from surplus subjects. The two routes draw on different populations rather than competing for the same recruits. Bursaries operate through the graduate labour market and can scale through existing ITT infrastructure. Retraining draws on serving teachers who are already in schools and past the high-attrition early career. Neither route alone can put a qualified specialist in front of every physics class. The relevant measure is not whether a single year's recruitment target is met but how much physics is taught by a specialist, and on that measure the shortage has persisted for a decade. Recruitment targets themselves have been revised sharply up and then down over that period, most recently cut by 43 per cent to 810 for 2026/27,[20] so the share of target met is a poor guide to whether the shortage is easing. Physics recruitment has recovered recently, but largely through overseas trainees whose bursary was withdrawn mid-cycle and a weak graduate labour market that tends to reverse, so it is not yet evidence of a durable change. The physics bursary is already at £29,000, while retraining programmes have been small and none has met its recruitment target. NFER's annual labour market review finds that the recruitment improvements of recent years were limited to a few shortage subjects and driven mainly by higher bursaries.[21] This section reviews the evidence on each route in turn.

Bursary levels and recruitment outcomes

The government's primary lever for addressing subject shortages has been the ITT bursary. Figure 5 shows the physics bursary trajectory alongside recruitment. Despite bursaries of up to £29,000, which exceed the median earnings of physics graduates one year after graduation, recruitment remained below target throughout most of that period.[22]

[20] Department for Education, 'Teacher Demand and Postgraduate Trainee Need, Academic Year 2026/27'.
[21] McLean and Worth, 'Teacher Labour Market in England Annual Report 2025'.
[22] LEO 2022/23: the median earnings of physics and astronomy graduates one year after graduation were £29,200 (Explore Education Statistics).

Figure 5: Physics ITT bursary level and recruitment against target, 2015/16 to 2025/26



A £10,000 bursary increase raises trainee numbers by approximately 29 per cent, according to the best available causal estimate. McLean et al. used two-way fixed effects on subject-level data to isolate the effect of bursary changes from year-specific and subject-specific confounders.[23] This is a recruitment effect only. The evaluation found no effect on the rate at which trainees obtain qualified teacher status, enter the state sector, or remain in teaching: additional trainees attracted by bursaries progress and are retained at the same rates as baseline entrants.

Not every trainee ends up teaching in a state-funded school. Of every 100 postgraduate trainees in the 2018 and 2019 qualifying cohorts, approximately 90 obtained qualified teacher status and 66 entered state-funded teaching within a year.[24][25] The cost-per-teacher-year calculations below apply this conversion rate to the additional trainees a bursary increase attracts.

A proportion of physics ITT entrants qualify via pre-ITT Subject Knowledge Enhancement (SKE), a DfE-funded short course for graduates whose degree does not provide sufficient subject coverage. Physics remains one of four funded SKE subjects in 2025/26, but DfE withdrew SKE funding for chemistry in March 2026 once chemistry recruitment recovered.[26] A similar withdrawal for physics would shrink the upstream supply of bursary-eligible trainees and reduce the recruitment yield from a given bursary increase.

How well this estimate applies to a further bursary increase today is uncertain. It was estimated across the £0-£30,000 bursary range from 2012-2021 data and varied across sub-periods, from 7

[23] McLean, Tang, and Worth, 'The Impact of Training Bursaries on Teacher Recruitment and Retention'.
[24] Department for Education, 'Initial Teacher Training Performance Profiles' (Department for Education, 2023).
[25] The most recent ITT Performance Profiles release (2023/24) shows slightly higher rates, with 93 per cent obtaining QTS and around 70 per cent entering state-funded teaching within a year. Using the 2018 and 2019 cohort figures preserves internal consistency with the post-entry retention rates used below, which are drawn from the same cohorts in DfE's Entering and Leaving Service data, and is conservative for the bursary route.
[26] Department for Education, 'Subject Knowledge Enhancement: Guidance for ITT Providers' (GOV.UK, 2026).

per cent in the earliest cohorts to 34 per cent in the most recent. The sensitivity analysis below uses a wide range (10-40 per cent) to reflect this uncertainty.

Bursary increases also change the composition of the applicant pool. Worth and Hollis found that a £10,000 increase is associated with a two percentage point rise in the proportion of male applicants and a two percentage point rise in over-40 applicants, alongside a four percentage point reduction in applications to employment-based routes.[27] London-based applicants are less responsive than those from the north of England. Worth and Hollis also note that both older entrants and male entrants have lower retention rates, so the long-term return per pound of bursary spending may be lower than the recruitment elasticity alone implies.

The McLean et al. elasticity is estimated on predominantly domestic 2012-2021 cohorts and does not reflect the overseas entrants who drove the recent rise. Because the overseas bursary eligibility behind that rise has since been withdrawn, the estimate and the policy it is now applied to cover the same population, and the two remain consistent.

Prior evidence on retraining

The overrecruiting side of the subject mismatch creates a potential pool for retraining. Teachers who entered the profession through subjects that overrecruit, such as PE or biology, are already established in schools and past the early-career years when annual attrition runs at roughly 6 per cent compared with 3 per cent for mid-career teachers (based on DfE Entering and Leaving Service cohort data used in the retention model below). A proportion may be willing to develop expertise in a shortage subject if supported by a well-designed programme. Four national retraining programmes have drawn from this pool since 2009 and are described in the next section.

The evidence on retraining covers programme design and short-term outcomes but has three gaps: no study has estimated cost per completer across programmes, no study has compared the cost-effectiveness of retraining with bursary recruitment, and whether retrained teachers continue teaching the target subject long-term is unmeasured. The only longitudinal evidence on retention comes from Sani and Burghes, who tracked eight participants in SKE+ (a small-scale maths retraining programme for serving teachers, separate from the four programmes analysed here) over four years and found that only half were still teaching maths by year three.[28] Their study identifies what supports teachers to remain in the retrained subject. Teachers with ongoing mentoring, collaborative practice, and senior management support continued teaching maths, while those without these supports reverted to their original subjects. However, their participants were teachers assigned to maths by their schools, a different population from physics teachers who volunteer for retraining.

Only one systematic evidence review covers professional development for out-of-field teachers. Rutgers et al., commissioned by the Gatsby Foundation, screened 492 items internationally and

[27] Jack Worth and Emma Hollis, ‘Do Bursaries Change Who Applies to Teacher Training?’ (NFER blog, 24 November, 2021).

[28] Naomi Sani and David Burghes, ‘Longitudinal Study of “Retraining” Non-Maths Specialist Teachers to Become Capable, Confident Teachers of Mathematics’, *International Journal of Mathematical Education in Science and Technology* 53, no. 9 (2022): 2438–64.

identified 31 studies that described or evaluated professional development programmes.[29] Of the 21 that measured impact, all reported positive changes in teachers' knowledge, practice, and attitudes. Four design features characterised effective programmes: sustained duration (typically six months to two years), collaboration with subject-expert facilitators and mentors, active learning through classroom experimentation, and a balance of subject content and pedagogical knowledge. These findings provide some confidence that well-designed retraining can improve teachers' subject knowledge, though none of the reviewed studies compared costs across routes.

Ireland halved out-of-field mathematics teaching (from 48 per cent in 2009 to 25 per cent in 2018) through a single government-funded retraining programme. The Professional Diploma in Mathematics for Teaching (PDMT) was a two-year, part-time programme delivered through 13 higher education institutions. Ireland's regulatory context differs because the Teaching Council requires specific subject qualifications, which creates institutional demand for retraining that does not exist in England's voluntary model. Rutgers' review identifies sustained institutional support and funded release time as conditions for programme success. The PDMT illustrates what a sustained programme can achieve at national scale, but the conditions under which it succeeded may not transfer directly to the English context.

Ireland has since applied a similar model to physics through the Professional Diploma in Teaching Physics (PDITP), a national upskilling programme designed for physics teachers who did not train in the subject.[30] Unlike the PDMT, the PDITP is physics-specific, making it a closer international comparator to the retraining programmes analysed here. No study has yet evaluated its cost or long-term outcomes, so it does not add new evidence on cost-effectiveness, but it confirms that another country has targeted the same shortage subject with a comparable qualification-linked approach.

The review also raises the question of whether retrained teachers should be reclassified as subject specialists. Research in Poland found that teachers who had acquired postgraduate qualifications to teach a second subject were still not considered fully "in-field" by their schools, and the review concludes that retrained teachers may "inhabit a space between in- and out-of-field." This uncertainty about whether retrained teachers are truly equivalent to degree-qualified specialists is central to the cost comparison and is addressed through the equivalence ratio in the analytical approach below.

Other countries have responded to similar shortages with retraining programmes, adjusted deployment rules, or subject-specific qualification requirements, but no country identified in the Rutgers review has formally compared the cost-effectiveness of these approaches.[31] This analysis addresses part of that gap by comparing two of them: retraining and bursary incentives.

[29] Rutgers et al., 'Understanding Subject Specific Professional Development for Out-of-Field Teachers'.
[30] Eilish McLoughlin, 'Remaking Physics Teacher Professional Learning: Designing a National Upskilling Programme for Physics Teachers', in *Advancing Physics Education: Innovations from Early Learning to Higher Education*, ed. Zuzana Ješková and Jozef Hanč, Challenges in Physics Education (Springer Nature Switzerland, 2025), 31–54.
[31] Rutgers et al., 'Understanding Subject Specific Professional Development for Out-of-Field Teachers'.

The retraining programmes

Rather than evaluating any single retraining programme against the bursary route, we construct a synthetic programme whose cost parameters are drawn from the range observed across the three national programmes that have provided physics-specific training and for which cost data are available. This section describes each programme, its cost and participation data, and any evaluation evidence. All three programmes develop both subject knowledge and subject-specific pedagogical knowledge, including how to sequence and teach curriculum content, but they range widely in intensity: from 25 contact hours to 320, from key stage 3 (KS3) and key stage 4 (KS4) focus to A-level depth, and from school-based INSET to multi-term taught programmes. The cost data available for each vary widely, which is why the synthetic programme approach is necessary. The following section explains how we combine these data into the cost comparison.

The three programmes are:

- **SASP** (Science Additional Specialism Programme, 2009-2011) was the most intensive programme, training approximately 700 physics and chemistry teachers to A-level depth over 320 hours of taught and school-based study. It is the only programme for which a long-term follow-up of participants has been attempted (Perry et al., 19 respondents) but only an indicative delivery-cost estimate could be reconstructed (see below).
- **TSST** (Teacher Subject Specialism Training, 2015-2020) was the largest programme, reaching 9,165 teachers across physics, maths, and modern languages with 25-50 contact hours, depending on provider. It has the lowest cost per completer but trained only to KS4 depth.
- **SKPT** (Subject Knowledge for Physics Teachers, 2022-present) is the current nationally funded physics programme, operating as six modules covering key stage 3 and 4 content. It has the richest published cost data of any programme but most participants complete only one or two modules.

A fourth programme, Specialist Knowledge for Teaching Maths (SKTM, 2020-present), is excluded from the cost comparison because it is not designed to produce specialist-equivalent teachers and no SKTM-specific cost or completion data are publicly available. It operates through 40 Maths Hubs for KS3 maths and reached 407 teachers in 2023/24, 57 per cent of target in its first two years. An EEF randomised trial is under way, with results expected in summer 2027.[32]

The data underlying this analysis come from multiple sources of varying completeness: published research reports, DfE evaluation documents, data requests to programme operators, interviews with current and former programme operators, and programme materials. No single source covers all three programmes, and data gaps are noted in the programme descriptions below, with their implications discussed in the limitations section.

[32] Education Endowment Foundation, ‘Specialist Knowledge for Teaching Mathematics — Trial’, 2025.

SASP

The Science Additional Specialism Programme ran from 2009 to 2011, retraining approximately 700 teachers across nine regional centres operated by the Science Learning Centres,[33] funded jointly by the then Department for Children, Schools and Families (DCSF) and the Gatsby Foundation. It was designed to improve the subject and pedagogical knowledge of non-specialist physics and chemistry teachers, equipping them to teach from KS3 through to A-level. The chemistry strand ended after approximately two years, with only the physics programme continuing into later cohorts.[34]

SASP was the most intensive of the three programmes analysed. It comprised 320 hours over 40 days across four terms: 240 face-to-face hours and 80 hours of structured independent study. Delivery models varied by region: some centres used residential blocks while others ran weekly day-release sessions throughout the year, with school-based practice periods between taught sessions. It trained teachers to A-level depth. This is the closest in scope to the full specialist qualification that degree-qualified physics or chemistry teachers hold.

The only follow-up of SASP participants was conducted by Perry et al., who surveyed 19 self-selected former participants approximately 13-14 years after programme completion.[35] Most were still teaching in schools or multi-academy trusts and several said they would have left teaching without it, while participants emphasised the quality and credibility of programme facilitators as essential to the experience. These are encouraging findings, but they come from a convenience sample of willing respondents who may not be representative of all 700 completers.

No formal completion rate data have been identified, so the analysis uses a sensitivity range of 70-95 per cent. Perry et al.'s 89 per cent still teaching after 13-14 years cannot fill this gap, because the self-selected sample noted above over-represents those who stayed and so measures neither completion nor retention.

Two papers published as SASP ran add detail on its scale and on how participants experienced it. Campbell records that around 180 teachers took part nationally in 2010/11, delivered through three universities and six Science Learning Centres and leading to a Graduate Certificate in Physics Education, with roughly a third of the London cohort teaching A-level physics within two years.[36] De Winter, reporting on the East of England cohort ($n = 22$), documents a shift in professional identity from science generalist to physics specialist: participants described developing subject-specific pedagogy through practical work and peer discussion, one noting they had come to understand "what's important to know and, crucially, what isn't worth knowing in depth", and several went on to take physics leadership roles.[37] Neither study evaluates pupil outcomes, but

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[33] The Science Learning Centre network was operated by Myscience, which later became STEM Learning.
[34] Emily Perry, Rachel Hartley, and James de Winter, 'A Scoping Study into the Long-Term Impacts of Additional Subject Specialism Professional Development' (Sheffield Hallam University, May 2024).
[35] Perry, Hartley, and de Winter.
[36] Peter Campbell, 'Enabling Non-Specialists to Teach School Physics Effectively', *Physics Education* 46, no. 2 (2011): 152–58.
[37] James de Winter, '"I No Longer Dread Teaching Physics, I Now Enjoy It!" Participant Reflections from the SASP Physics Course', *Physics Education* 46, no. 2 (2011): 159–66.

both are consistent with the high equivalence the cost comparison would require of a SASP-style programme.

DfE funded SASP for a £5,000 completion bonus paid to teachers and up to £6,000 to schools for supply cover (£150 per day in 2010/11 prices). An indicative figure for programme delivery can be reconstructed from two contemporary sources from January 2009: video conference minutes and programme notes from the National Science Learning Centre programme lead. Both record a delivery cost of £3,000 per student in 2008/09 prices, split as £2,250 to the regional Science Learning Centres for delivery and £750 to the National Science Learning Centre for administration. Deflated to 2024/25 prices using the GDP deflator, this is approximately £4,500 per student, or about £19 per face-to-face hour over the 240-hour curriculum.

This per-hour figure sits just below the £20-£60 range used in the synthetic programme analysis, but it is not a fully-loaded delivery cost. The Science Learning Centre network was supported by main government funding and substantial Wellcome Trust investment in the National Science Learning Centre, so overheads such as facilities, leadership, and quality assurance were absorbed into the wider infrastructure rather than charged to SASP. By contrast, TSST's delivery grant of approximately £1,800 per participant in 2024/25 prices, spread over 25-50 hours of contact time, implies a per-hour cost of £36-£72 — substantially higher despite covering less content. The 2009 SASP figure is best read as a floor estimate of programme-specific delivery cost rather than a comparable per-hour rate. Table 2 summarises the available cost data.

Table 2: SASP: available cost data per participant (nominal values adjusted to 2024/25 prices using GDP deflator)

Cost category	Per participant	Notes
Programme delivery (indicative)	£4,500	£3,000 in 2008/09 prices; excludes SLC infrastructure overhead
Bursary to teacher	£7,300	£5,000 completion bonus (2010/11 nominal)
Cover bursary to school	£8,800	Up to £6,000 (2010/11 nominal)
Total financial cost (including indicative delivery)	£20,600	Delivery figure is indicative only

TSST

TSST was the largest of the three programmes but the least standardised in design. Launched in 2015 as part of the government's Maths and Physics Teacher Supply Package,[38] it ran until 2020 and reached 9,165 teachers across physics, maths, and modern languages (61 per cent of the 15,000 target), funded by DfE at a total cost of £67 million. Unlike the centrally designed SASP, TSST was initially delivered through the Science Learning Partnerships (successors to the regional Science Learning Centres) and later through a broader network of 115 lead organisations, mostly schools but including university-hosted providers and Science Learning Partnerships, each responsible for designing and running its own programme. DfE set no fixed contact-hour requirement until a minimum specification was introduced in 2017, and even then the Institute of

[38] Suzanne Straw et al., 'Maths and Physics Teacher Supply Package: Research Report' (Department for Education, March 2017).

Physics required only 30-50 hours for physics course approval, roughly a tenth of SASP's 320 hours.[39]

The available cost and outcome data for TSST are partial. The goal was to train teachers to KS4 level rather than A-level, with provider bursaries ranging from £400 to £780 per participant. The £67 million total cost figure covers the broader STEM teaching package, not TSST alone. The package also included CPD for primary teachers and other activities unrelated to TSST, alongside DfE administration, regional coordination, and evaluation, so dividing the total by TSST participants would substantially overstate the programme-specific cost per participant. Completion rates were very high where data are available, at 99 per cent for physics and 97 per cent for secondary maths in 2016/17, but these rates come from DfE's own evaluation reports, which relied on self-reported data from lead schools and did not measure whether completers continued teaching the target subject or how effective they were in the classroom.[40] Table 3 summarises the available cost data.

Table 3: TSST: available cost data per participant (nominal values adjusted to 2024/25 prices using GDP deflator)

Cost category	Per participant	Notes
Delivery grant to schools	£1,800	£1,400 per participant; 2018/19 nominal
Bursary to teacher	£400–£780	Varies by provider; 2019/20 nominal; not included in delivery grant
Cover bursary to school	—	Not separately available
Total STEM package	£9,600	£67m for 9,165 participants; includes DfE admin and non-TSST elements

SKPT

SKPT is the only currently operating programme of the three and has the richest cost data. The programme launched in summer 2022 as part of a national Science CPD Partnership contract led by STEM Learning and funded by the Department for Education. STEM Learning is the prime contractor; the Ogden Trust delivers part of the programme on behalf of STEM Learning. The original contract ran to August 2024, was extended in 2023 to April 2025, and was extended again in 2025 to April 2026 with higher completion targets and an increase in module subsidies to up to £600 per module. The annual programme budget for the post-extension period is £3.35 million, fully DfE-funded.

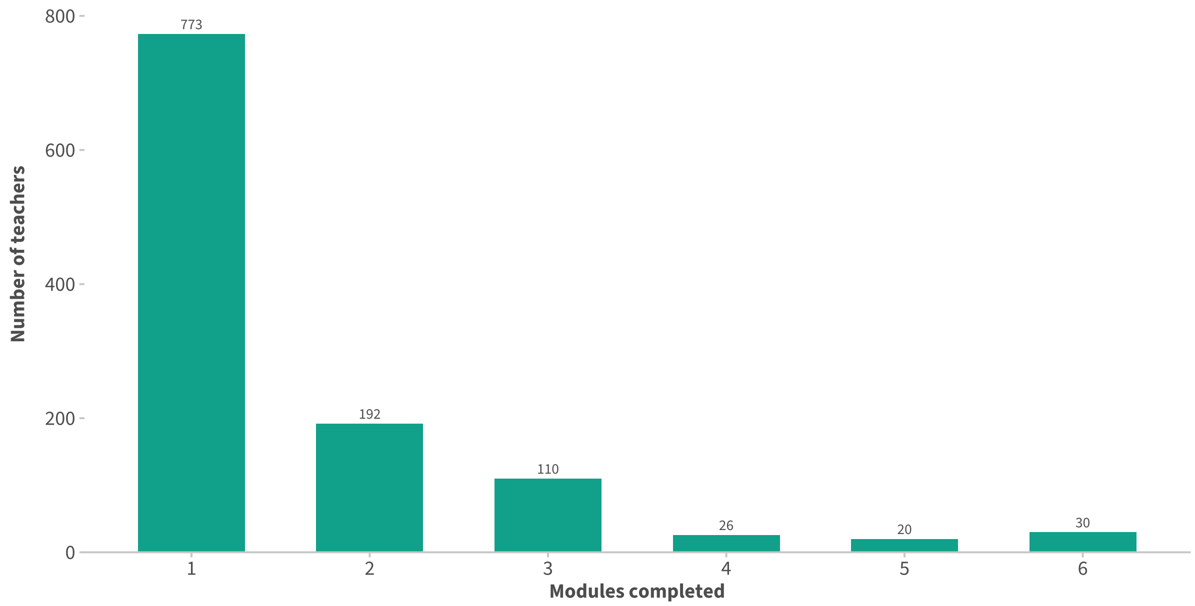
SKPT is structured as six physics modules progressing from KS3 foundations through KS4 content. It does not train teachers to A-level. The modules are delivered in five formats, ranging from in-school bespoke sessions to a multi-day residential, each with different time commitments, completion rates, and bursary levels.

[39] Department for Education, 'TSST Application Guidance 2018–19', 2018.
[40] Department for Education, 'Teachers Analysis Compendium 4: Analysis of Teacher Supply, Retention and Mobility' (Department for Education, September 2018); Straw et al., 'Maths and Physics Teacher Supply Package'.

At the lightest end, a school can host bespoke sessions on its own premises (8 face-to-face hours split over at least two sessions, plus 12 hours of online study), where about 65 per cent of participants complete the full module including the online component. Teachers can also attend one- or two-day courses at regional or national centres (16 face-to-face hours per module, 80 per cent completion). At the most intensive end, a four-day residential covers three modules (29 face-to-face hours, 95 per cent completion) and a weekly programme covers all six modules across an academic year (60 face-to-face hours, estimated 95 per cent completion). Bursaries are paid to schools to contribute to the cost of releasing teachers from timetable commitments, ranging from £100 for the bespoke format to £5,000 for the intensive year-long programme. Bespoke delivery attracts the lowest bursary because schools choose the date and avoid most cover costs; the larger bursaries for residential and intensive formats reflect the more substantial supply cover required.

Of 1,151 unique teachers participating between 2022 and 2025, 773 (67 per cent) completed exactly one module and only 30 (2.6 per cent) completed all six. The average was 1.6 modules per teacher. Figure 6 shows the distribution. The modular design lets teachers take the modules most relevant to their teaching rather than work through a fixed curriculum, so completing one module does not mean a teacher has finished. Participant surveys for the programme indicate that most intend to complete further modules, and the number returning for additional modules is rising year on year. The same feedback identifies release from school, rather than willingness, as the main barrier to completing more. The cost figure used here is unaffected by how many modules each teacher eventually takes, because it is measured per module completion rather than per teacher.

Figure 6: SKPT: number of teachers by modules completed (2022-2025). Source: STEM Learning.



The potential system-level impact of SKPT depends on how retrained teachers compare with degree-qualified specialists. The Institute of Physics (IoP) calculated that 200 teachers completing all six modules would reduce the physics ITT recruitment target by approximately 280, reflecting the retention advantage of mid-career teachers.[41] However, this calculation assumes each SKPT completer is fully equivalent to a newly recruited specialist ($\alpha = 1$), adjusting only for differential retention. The IoP itself acknowledged the gap, recommending that the Subject Knowledge Award be developed into a formal qualification, that SKPT be extended to A-level content, and that release time be fully funded. Table 4 summarises the available cost data.

Table 4: SKPT: available cost data (2024/25 prices)

Cost category	Amount	Notes
Delivery cost per module	Available but not published	Provided in confidence
Bursary to school per module	£100–£5,000	Ranges from bespoke to intensive format; contributes to school release costs
Annual programme budget (2025/26)	£3m	Fully DfE-funded; covers delivery, bursaries, administration and quality assurance
Non-bursary cost per module	£1,000	Total budget minus bursaries divided by 1,800 forecast modules (2025/26)
Ogden audited direct cost per module (steady state)	£290–£327	Ogden Trust direct share only; 2023/24 and 2024/25 audited (Ogden Annual Reports)

The cost data are best read at three scopes. At system level, the £3.35 million annual budget divided by the 1,800 module completions forecast for 2025/26, net of the £1.43 million bursary pot paid to schools, gives £1,067 per module for the non-bursary component (delivery, administration, and quality assurance combined). At the per-completion level, the bursary itself ranges from £100 to £5,000 by format, paid to schools to contribute to release costs. At the direct-delivery level, the Ogden Trust's audited accounts give Ogden's own direct expenditure on SKPT at £290 per module in 2023/24 and £327 per module in 2024/25; this is a subset of the full programme cost because STEM Learning, as prime contractor, retains the larger share of the DfE-held contract and does not disclose Science CPD turnover separately in its annual report. The three figures are at different scopes and are not estimates of the same quantity.

The audited annual trajectory shows 403 module completions in 2022/23, 608 in 2023/24, and 842 in 2024/25, alongside Ogden direct expenditure of £228,906, £176,264, and £274,822 respectively. The 2022/23 unit cost (£568 per module) reflects first-year setup carry-over rather than steady-state delivery. The synthetic programme used for the cost comparison draws on the per-format delivery cost range rather than the system-level figure, because the synthetic programme varies both intensity and format independently of any single delivery model.

Programme summary

Table 5 summarises the key features of the three programmes.

[41] Institute of Physics, 'The Physics Teacher Shortage and Addressing It Through the 3Rs: Retention, Recruitment and Retraining (England)' (Institute of Physics, September 2025).

Table 5: Summary comparison of the three retraining programmes

Programme	Period	Operator	Subject(s)	Scope	Hours	Scale	Completion rate	Data status
SASP	2009-2011	STEM Learning / Science Learning Centres	Physics, chemistry	To A-level (KS5)	320 (240 f2f + 80 self-study)	~700 total (~500 physics)	Unknown (est. 70-95%)	Historical; no delivery cost data
TSST	2015-2020	Multiple providers (DfE-funded)	Physics, maths, MFL	KS4 focus	25-50 (varies by provider)	9,165 total	97-99% (self-reported)	Total expenditure available; no cost breakdown
SKPT	2022-present	STEM Learning + Ogden Trust	Physics	KS3/KS4 (not A-level)	20 per module; 120 for full 6-module programme	1,151 unique teachers (2022-25)	65-95% per module (format-specific)	Richest data of any programme

Analytical approach

The question this report addresses is this: if the government spends one more pound on increasing the number of specialist teachers, does that pound go further on bursaries or on retraining? Answering it requires putting both routes on a common footing so their costs can be compared like-for-like.

This is a marginal cost-effectiveness analysis. It compares two active policy options rather than comparing either with inaction, asking which route delivers more specialist teaching for the next pound spent. The unit of comparison is one additional year of specialist teaching, referred to throughout as a "teacher-year" (discounted at 3.5 per cent per year; see the cost framework below). One teacher remaining in post for 10 years generates 10 teacher-years, and two teachers each staying five years also generate 10. This unit captures both the upfront cost of producing a specialist and how long that specialist stays in the profession. The route that produces more teacher-years per pound is more cost-effective at the margin.

The cost drivers differ between the two routes. For retraining, the cost per teacher-year depends on how much it costs to put a teacher through a programme, how many participants complete it, how their teaching compares with that of a degree-qualified specialist, and how long they continue teaching the target subject. For the bursary route, the cost depends on how many extra trainees a given bursary increase attracts, recognising that the increase must be paid to everyone who would have trained anyway, and then on how long those additional teachers stay. Retrained teachers face a risk that bursary-route teachers do not: they may revert to teaching their original subject. The key assumptions section discusses this and the other assumptions that substitute for missing data.

The rest of this section sets out six building blocks of the comparison, from the definition of costs through to the key assumptions. The following two sections then present the cost estimates for each route separately before comparing them in three ways: the cost per additional teacher-year at the margin, the break-even equivalence ratio (how ineffective retrained teachers would need to be before bursaries became cheaper), and a budget allocation scenario showing how many specialists each route produces from a fixed budget.

Cost framework

Running a retraining programme involves several types of cost: the provider incurs delivery costs (facilitators, venues, materials), the government pays bursaries and completion bonuses, schools bear the cost of releasing teachers from timetabled lessons, and teachers themselves spend time in training rather than teaching. Not all of these fall on the public purse, so the analysis takes two perspectives. The financial cost perspective captures spending by government and programme funders. The economic cost perspective adds costs borne by schools and teachers. Both perspectives measure costs to the public sector and its workforce. Capturing downstream benefits to pupils or wider effects on teachers' careers would require a cost-benefit analysis that measured the benefits of each policy alongside the costs. This analysis compares costs only.

Following HMT Green Book terminology, the analysis uses two cost scopes.[42]

- **Financial cost** is the total public spending on the programme. It includes the direct cost of running training sessions, programme administration, quality assurance, coordination, and all bursaries paid by government or funders to the teacher and to the school.
- **Economic cost** adds costs borne by schools and teachers that do not appear in public accounts. It includes the opportunity cost of the teacher's time in training, valued using the teacher's salary and their total annual directed time (the maximum hours a teacher can be required to work, set at 1,265 hours per year), and any school cover costs not already reimbursed by the cover bursary.

Two adjustments ensure the costs are comparable across programmes and over time. First, because the four programmes operated in different years, all costs are converted to 2024/25 prices using the GDP deflator (ONS series L8GG), the measure recommended by the HMT Green Book for public expenditure appraisals, so that a pound spent in 2010 is expressed in terms of what it would cost today.

Second, because a year of teaching delivered five years from now is worth less than one delivered immediately (the government could invest the money in the meantime), future teacher-years are discounted at 3.5 per cent per year, the standard rate used in HMT Green Book appraisals. This discounting applies to the stream of teacher-years each cohort of completers generates over the comparison horizon. On the bursary side, the same logic applies to the Targeted Retention Incentive Payment (TRIP), an annual bonus paid to early-career teachers in shortage subjects over their first five years in post, described in the bursary marginal cost section below.

The analysis covers operating costs only, excluding programme development, curriculum design, accreditation, and setup costs because the available data do not separate them from ongoing delivery. This exclusion is asymmetric: a new retraining programme would incur startup costs with no bursary-route equivalent, since the bursary operates through the existing ITT market.

The cost estimates draw on a mix of published and provider-supplied data. Bursary levels, recruitment figures, completion rates where available, and published programme accounts come from public sources: DfE statistics and funding manuals, NFER analysis, published evaluations, and audited annual accounts. Some programme delivery costs were provided by delivery partners in confidence. Where a figure was provided in confidence, it appears in this report only in aggregated or range form, and specific cost figures are not attributed to individual providers. The synthetic programme parameters are expressed as per-hour cost ranges rather than any single provider's figures. The full analytical audit trail, including the confidence-protected inputs, is held internally and does not form part of this published report.

Retraining cost per completer

Not every teacher who starts a retraining programme finishes it. The relevant cost figure is therefore the cost per teacher who completes the programme, not the cost per participant, since only completers contribute to the specialist workforce. This metric is defined as total programme

[42] HM Treasury, 'The Green Book: UK Government Guidance on Appraisal' (HM Treasury, 2026).

cost divided by the number of teachers who successfully finish. For SASP, where the completion rate is unknown, costs are presented across a range of plausible completion rates (70-95 per cent) rather than a single point estimate. The high-cost scenario uses the low end of this range (70 per cent) because a programme spanning several terms exposes participants to changing timetable pressures, staff turnover, and competing priorities that accumulate over time. Within SKPT's short modules, residential formats have the highest completion rates because participants commit to a few days away from school and complete the work in a single block. A multi-term programme like SASP requires sustained engagement over an academic year, and each term creates a new point at which a participant may withdraw.

As described in the programme overview, the retraining route uses a synthetic programme whose parameters span the range observed across all three programmes, with three scenarios (low cost, central, high cost) testing whether the conclusion holds across different assumptions about programme design and intensity.

Bursary marginal cost

For the bursary route, the question is how much it costs to attract one extra trainee who would not otherwise have entered teaching. This is not the same as the bursary itself because, when the government raises the bursary by £1,000, it pays that increase to every trainee, including the vast majority who would have applied anyway. The cost of the additional trainees the increase attracts must therefore include this payment to existing entrants. In addition, each extra trainee the bursary attracts incurs the cost of an ITT place (tuition, placement supervision, and university overhead), estimated at £22,000 in 2022/23 prices by Allen et al. and varied from £22,000 to £35,000 in the sensitivity analysis to reflect the age of this estimate.[43] These training costs are borne jointly by government, universities, and placement schools, and are included in the bursary route cost throughout.

The analysis replicates the NFER marginal cost arithmetic for the physics-specific case.[44] It models a £1,000 increase, the smallest typical policy increment. A larger increase would raise the per-trainee cost because each additional recruit receives the full bursary plus the increase. The NFER central estimate is that a £10,000 bursary increase raises trainee numbers by 29 per cent. This is a semi-elasticity (the percentage change in trainees for a given absolute change in the bursary), not a standard price elasticity. The analysis uses three elasticity scenarios: a low estimate of 18 per cent (the overall estimate across earlier cohorts), the central 29 per cent, and a high estimate of 34 per cent (the estimate for the most recent 2018-2021 cohorts). Scaling linearly, a £1,000 increase from the current level of £29,000 attracts approximately 32 additional trainees per year.

The marginal cost per additional specialist teacher is far higher than the bursary level alone, because the increase must be paid to all existing trainees, not just the additional ones it attracts. The analysis uses the 1,095 postgraduate physics entrants in 2025/26 as the baseline.[45] This is

[43] Rebecca Allen et al., 'The Longer-Term Costs and Benefits of Different Initial Teacher Training Routes' (Institute for Fiscal Studies, July 2016).
[44] McLean, Tang, and Worth, 'The Impact of Training Bursaries on Teacher Recruitment and Retention'.
[45] Department for Education, 'Initial Teacher Training Census, Academic Year 2025/26'.

historically high: PG physics entrants ranged from 427 to 679 between 2019/20 and 2024/25. It sits below DfE's target of 1,410 for that year, a target since cut to 810 for 2026/27.[46] The choice of baseline does not affect the cost per additional teacher-year, because both the total inframarginal cost and the number of additional trainees attracted scale proportionally with entrant numbers, so the per-unit ratio is the same regardless of cohort size. It does, however, affect the total fiscal cost of a bursary increase and the budget scenarios presented later.

This payment to existing entrants (the "inframarginal cost," in economic terminology) dominates the calculation. The analysis models only the recruitment channel (additional trainees attracted by the bursary increase), not any retention effect of higher starting packages on teachers once in post. For an ITT bursary, which is a pre-service payment that does not directly improve in-service pay, this channel is indirect and likely small relative to the inframarginal cost.[47]

From 2024/25, the Targeted Retention Incentive Payment (TRIP), which replaced the Levelling Up Premium (LUP), is added to the bursary route's cost. TRIP pays £3,000-£6,000 per year to early-career teachers in shortage subjects at eligible schools.[48] Not all schools are eligible for TRIP, and eligible schools receive different amounts depending on their Pupil Premium decile and location. Averaging across all state-funded secondary schools (weighting by the number of physics teachers in each school, and treating non-eligible schools as receiving zero) gives a mean TRIP payment of £2,747 per year. The NFER elasticity was estimated from 2012-2021 data, predating both LUP (introduced 2022/23) and TRIP. Early-career payments for physics were available from 2020/21, overlapping with the final year of the estimation window, but those payments targeted retention rather than recruitment and so should not materially affect the bursary recruitment elasticity. There is therefore no double-counting risk in adding TRIP costs separately.

TRIP accrues only to the bursary route because it is paid to the additional early-career teachers the bursary increase attracts. Retrained teachers are ineligible: TRIP requires either ITT in a shortage subject or a relevant degree, so teachers who retrained through a CPD programme do not qualify.[49]

The equivalence ratio

A teacher retrained through a 200-hour programme may not match a graduate with a full physics degree in every respect. Comparing the two routes on cost alone would be misleading if they produce teachers of different quality, so the analysis needs a way to account for this gap. The parameter it uses is the equivalence ratio (α), which captures all differences in mean teaching effectiveness between the two routes: subject knowledge, subject-specific pedagogical knowledge, curriculum familiarity, and any other dimension on which retrained teachers differ from degree-qualified specialists. An α of 1.0 means fully equivalent; 0.5 means half as effective. The goal of any retraining programme should be to push α as close to 1.0 as possible, because α is a measure of programme quality, not a target to be minimised in pursuit of lower costs.

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[46] Department for Education, 'Teacher Demand and Postgraduate Trainee Need, Academic Year 2026/27'.
[47] Sam Sims and Asma Benhenda, 'The Effect of Financial Incentives on the Retention of Shortage-Subject Teachers: Evidence from England' (UCL Centre for Education Policy and Equalising Opportunities, 2022).
[48] Department for Education, 'Targeted Retention Incentive Payments for School Teachers', 2025.
[49] Department for Education.

No empirical estimate of α exists, so the analysis treats it as a break-even parameter: how low would α need to fall before retraining stops being cost-effective? A low break-even value means the cost margin between the two routes is wide, and retraining would need to produce very poor specialists before a bursary increase became the cheaper option.

The Metzler and Woessmann evidence discussed earlier suggests that differences in subject depth do translate into differences in teaching effectiveness, so programme depth provides a rough guide to plausible α values. A 320-hour programme training to A-level (such as SASP) covers content approaching what a degree-qualified teacher holds, suggesting α close to 1.0. SASP also integrated subject-specific pedagogical content knowledge (how to teach the curriculum, not just what is in it) alongside subject knowledge to a depth that standard ITT routes do not provide, because a one-year PGCE or SCITT must cover assessment, behaviour management, professional conduct, and many other topics alongside subject-specific pedagogy. A 25- to 120-hour programme covering KS3/KS4 content (such as TSST or SKPT) covers less content, implying a lower α. A crude comparison of programme hours against the total hours of subject-specific study in a degree (roughly 1,500-1,800 hours under the Bologna Process framework) would suggest very low values of α even for intensive programmes, but such a comparison is uninformative: the content and purpose of a retraining programme designed for practising teachers differs fundamentally from undergraduate study, and α is intended to capture teaching effectiveness, not hours of study. This is why the analysis treats α as a break-even parameter rather than attempting to estimate it.

Retention

The value of producing an additional specialist teacher depends not just on the initial cost but on how long that teacher stays in the profession. A teacher who remains in the profession for 10 years delivers 10 times as many teacher-years as one who leaves after one year, so retention is an important element of cost-effectiveness.

Retraining programmes draw from existing teachers who are, on average, further into their careers than the early-career teachers entering through the bursary route. Mid-career teachers (year eight and beyond) are retained at a rate of 96.8 per cent annually, compared with approximately 87 per cent for teachers in their first year (derived from DfE Entering and Leaving Service data, 2010-2017 cohorts), so each retrained completer is expected to generate more teacher-years per pound invested. On the bursary side, McLean et al. found no effect of bursaries on post-entry retention, so additional trainees attracted by higher bursaries are retained at the same rates as the baseline cohort.[50]

However, not all retraining participants are mid-career. The only career-stage evidence comes from Perry et al., who found SASP participants were split, with roughly half having fewer than five years' experience and half having six or more years.[51] No career-stage data are available for TSST or SKPT participants. Our central estimate of the retraining cost per teacher-year uses the mid-

[50] McLean, Tang, and Worth, 'The Impact of Training Bursaries on Teacher Recruitment and Retention'.
[51] Perry, Hartley, and de Winter, 'A Scoping Study into the Long-Term Impacts of Additional Subject Specialism Professional Development'.

career retention rate of 96.8%, which may overstate retention if a substantial share of participants are early-career. As a sensitivity we model some retrainees as entering the retention curve earlier in their careers, where annual retention starts lower and rises with experience rather than sitting on the mid-career plateau. The alternative scenario treats the cohort as a 50/50 mixture of mid-career and early-career teachers, following the Perry split. This narrows the cost gap modestly but does not overturn the conclusion that retraining is far cheaper per teacher-year; the structural sensitivity results report its effect in full.

The model does not include a separate programme-specific retention effect beyond what career stage predicts, because there is no evidence for a causal effect. Perry et al.'s finding that most respondents were still teaching 13-14 years later provides qualitative support for a positive effect, but as described in the SASP section, the sample is too small and likely too skewed to draw firm conclusions. If a positive effect does exist, it would reduce the retraining cost per teacher-year and strengthen the comparison result.

Key assumptions

Several inputs to the comparison are assumed rather than measured. The direction of bias each assumption introduces, and how the analysis addresses it, are summarised here.

On the retraining side, the model assumes completers teach the target subject for the full comparison horizon. As noted in the evidence review, no programme has tracked this, so if retrained teachers revert to their original subject at higher rates than they leave the profession, the model overstates the teacher-years retraining delivers. The sensitivity analysis cannot address this directly because no data exist to define a plausible range. The limitations section discusses the available evidence on whether retrained teachers stay in the target subject.

The model applies mid-career retention rates (96.8% annually) to all retrained teachers. This is based on the Perry et al. career-stage evidence described in the retention section. The sample is small and likely skewed towards those who remained in teaching. If a larger share of participants are early-career, the true retention rate would be lower, raising the retraining cost per teacher-year. The sensitivity analysis tests a 50/50 mixture of mid-career and early-career retrainees as an alternative.

The model also treats all teacher-years as equally valuable, regardless of how long the teacher has been teaching the subject. In practice, teachers who have taught a subject for several years are likely more effective than those in their first year of teaching it, so a year of specialist teaching delivered later is worth more than one delivered immediately after retraining. This applies to both routes but affects them differently: retrained teachers begin with less subject-specific teaching experience than degree-qualified entrants. If returns to subject-specific experience are large, the model understates the quality gap between the two routes in the early years.

On the bursary side, additional trainees are assumed equally effective as baseline entrants. The NFER evaluation found no difference in QTS completion or early retention, but as noted in the bursary evidence review, Worth and Hollis found that bursary increases shift the composition of the applicant pool towards groups with lower observed retention.[52] If additional trainees are retained at lower rates, the bursary cost per teacher-year would be higher than the central estimate. The sensitivity analysis varies the elasticity but not the retention profile of additional trainees, so any such bias is unaddressed.

The net direction of these assumptions is uncertain but more of the identifiable biases favour the retraining route than the bursary route. The probabilistic sensitivity analysis tests how much the cost comparison changes when the measurable parameters are drawn from wide ranges.

[52] Worth and Hollis, 'Do Bursaries Change Who Applies to Teacher Training?'

Cost of retraining teachers

The cost of retraining a teacher depends on programme intensity, completion rates, and how costs are shared between government and schools. The synthetic programme draws its parameters from the range observed across the four programmes described above, separating delivery cost into direct delivery cost and programme overhead. Direct delivery cost (£20-£60 per contact hour) is derived from per-format delivery cost data spanning formats from school-based training days to multi-day residential blocks. The individual format costs were provided in confidence and are not published here, but the range they span sets the synthetic programme parameters. TSST's delivery grant to schools and an indicative quote for a shorter SASP variant are consistent with this range but measure a broader scope that includes coordination overhead.

Programme overhead (administration, quality assurance, and coordination) is estimated separately at £1,500-£5,000 per participant. The central estimate of £3,000 is informed by available programme budget data, but the range is wide because the overhead depends on programme scale and organisational structure in ways that the limited evidence cannot pin down. The cost data received from programme providers did not separate fixed and variable components, so all costs in this analysis, including overhead, are modelled as constant per participant. In practice, some overhead costs (accreditation, curriculum development, quality assurance infrastructure) do not scale with participant numbers, meaning the per-participant cost would fall at higher volumes and rise at lower ones. The implications of this for the cost comparison are discussed in the limitations section.

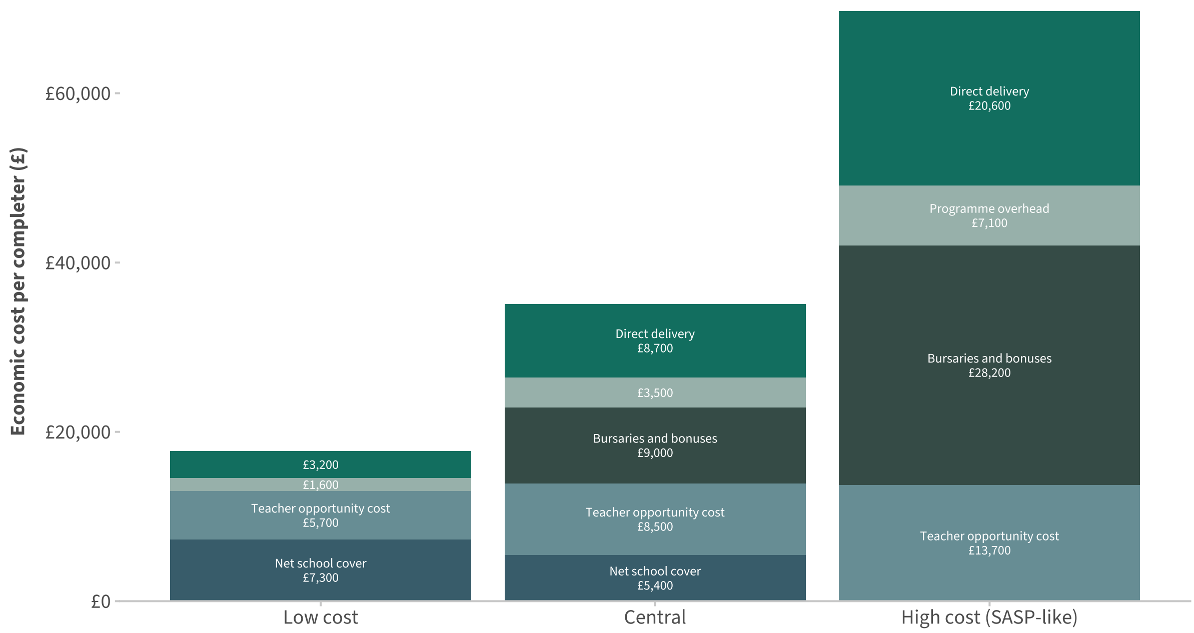
Table 6 breaks down the assumed parameters and costs of the synthetic programme into three layers. The first section sets out the programme's scale: how many hours of training and how many days a teacher spends out of the classroom. The second section shows the direct financial cost: delivery, overhead, bursaries, and bonuses, summing to a financial cost per completer after adjusting for non-completion. At the central estimate, each training day costs approximately £590 per participant in financial spending alone. The third section adds the wider costs that fall on teachers and schools: the opportunity cost of a teacher's time (valued as the proportion of their annual salary the programme hours absorb) and the cost of arranging classroom cover for the days they are absent, net of any cover bursary received. Including these wider economic costs roughly doubles the total.

Table 6: Synthetic programme: cost parameters, financial cost, and wider economic cost by scenario (£, 2024/25 prices)

	Low cost	Central	High cost (SASP-like)
Contact hours	150	200	240
Self-study hours	30	40	80
Total programme hours	180	240	320
Training days out of classroom	23	31	37
Direct delivery	£3,000	£7,400	£14,400
Programme overhead	£1,500	£3,000	£5,000
Cover bursary	£0	£4,600	£14,800
Completion bonus	£0	£3,000	£5,000
Financial cost per participant	£4,500	£18,000	£39,200
Teacher opportunity cost	£5,400	£7,200	£9,600
Gross school cover cost	£6,900	£9,200	£11,100
Net school cover (after bursary)	£6,900	£4,600	£0
Economic cost per participant	£16,800	£29,800	£48,800
Completion rate	95%	85%	70%
Financial cost per completer	£4,700	£21,200	£56,000
Economic cost per completer	£17,700	£35,100	£69,700

Figure 7 shows the economic cost per completer from the table as a stacked bar chart, making the relative weight of each component easier to compare across scenarios.

Figure 7: Economic cost per completer by component: synthetic programme scenarios (£, 2024/25 prices)



Three features of the cost structure stand out in Figure 7. First, teacher time costs (opportunity cost plus net school cover) are the largest component in the central and high-cost scenarios. Every hour of training is an hour a teacher is not in the classroom, so schools must arrange cover. In addition, the teacher's time has an opportunity cost valued at their salary. Because both scale directly with programme hours, the choice of programme intensity is the single most important cost lever. A programme designer adding an extra day of training faces a marginal economic cost well above the provider's delivery fee alone, because teacher time and cover costs are incurred on top of the delivery cost, though that may not always be reflected in the financial cost.

Second, direct delivery costs also grow with programme intensity, but the increase is less rapid because delivery cost per hour is lower than the combined per-hour cost of teacher time and cover.

These two variable cost components (teacher time and delivery) together explain most of the cost difference across scenarios. The remaining components are either fixed or discretionary. Programme overhead does not scale with programme hours, so it is proportionately smaller in more intensive programmes and its effect on the comparison is modest.

Bursaries and completion bonuses are policy design choices rather than costs driven by programme delivery, but they are not trivial: in the central and high-cost scenarios, they account for over 40 per cent of the financial cost per participant. The low-cost scenario sets both to zero, showing how large the effect could be in principle, though in practice these payments may be necessary to attract and retain participants.

The comparison section below presents results under both financial and economic costs so that the effect of school-borne costs on the cost-effectiveness conclusion is visible. The bursary route has no comparable economic cost adjustment because its costs are entirely financial (bursary payments, training costs, TRIP). This asymmetry reflects a genuine difference between the two routes rather than an artefact of the analysis. Retraining requires serving teachers to spend time away from their classrooms, imposing opportunity and cover costs on schools that the bursary route, which operates through pre-service training, does not.

Cost of bursary recruitment

The cost of attracting one additional specialist through a bursary increase is driven by the inframarginal payment to existing entrants described in the analytical approach. The second driver is the time horizon, because the longer additional teachers stay, the more teacher-years the fixed upfront cost is spread across. The analysis presents results at 5- and 10-year horizons. Five years covers the early-career period when retention diverges most sharply between early-career and mid-career teachers, and coincides with the TRIP payment window. Ten years tests whether the conclusion holds over a longer period, though the effect is smaller because retention rates converge as early-career teachers move into mid-career.

Table 7 shows how the cost builds up for a £1,000 increase applied to 1,095 physics entrants at the central NFER elasticity of 29 per cent.

Table 7: Bursary route: how costs accumulate for a £1,000 bursary increase (£, 2024/25 prices, central elasticity)

	5 years	10 years
Inframarginal cost (increase paid to all entrants)	£1,095,000	£1,095,000
Bursary for additional trainees	£952,600	£952,600
Training cost for additional trainees	£753,200	£753,200
Total upfront cost	£2,800,900	£2,800,900
Additional trainees attracted	31.8	31.8
Additional teachers reaching year 1	18.2	18.2
Cumulative discounted teacher-years	73.1	121.8
Cumulative TRIP payments	£221,500	£221,500
Total cost	£3,001,800	£3,001,800
Cost per additional teacher-year	£41,000	£24,600

The table reads from top to bottom. The first section shows the upfront cost. The £1,000 increase is paid to all 1,095 existing entrants, costing £1,095,000 before a single additional trainee is attracted. The bursary and training costs for the 31.8 additional trainees add £1,705,900, bringing the total upfront cost to £2,800,900. The training cost component reflects the cost of ITT places for those additional trainees, estimated at £23,700 per place (deflated to 2024/25 prices).[53] This estimate originates from 2016 and no more recent published alternative exists, so the sensitivity analysis uses a wide range (£22,000-£35,000) to reflect the additional uncertainty. These are additional places that would not have been funded without the bursary increase, so the full training cost is attributable to the policy.

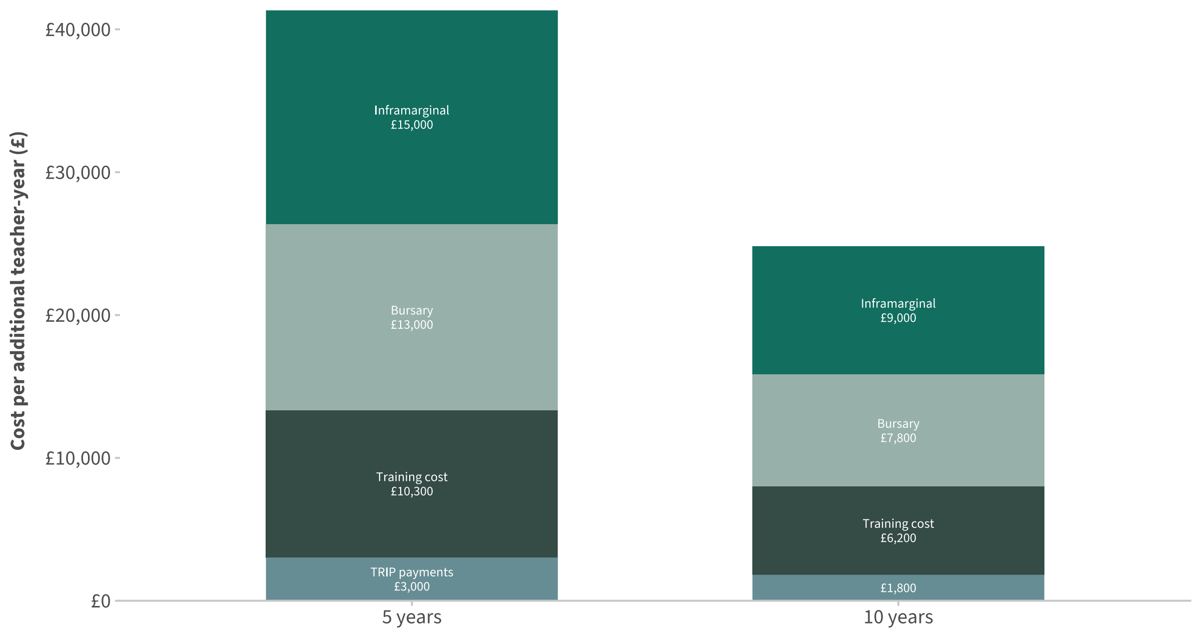
The second section shows how many of those additional trainees reach the classroom and how many cumulative teacher-years they produce at each time horizon, after applying the NFER retention trajectory and discounting at 3.5 per cent. The third section adds TRIP payments, which accrue to additional early-career teachers still in service during years 1-5, to give the total cost.

[53] Allen et al., 'The Longer-Term Costs and Benefits of Different Initial Teacher Training Routes'.

Dividing the total cost by cumulative discounted teacher-years gives the cost per additional teacher-year in the final row.

Figure 8 shows the cost per additional teacher-year broken into its four components at each time horizon. The inframarginal payment dominates at every horizon. All components fall as the horizon extends, because the fixed upfront costs are spread across more teacher-years.

Figure 8: Cost per additional teacher-year by component and time horizon (£, 2024/25 prices, central elasticity)



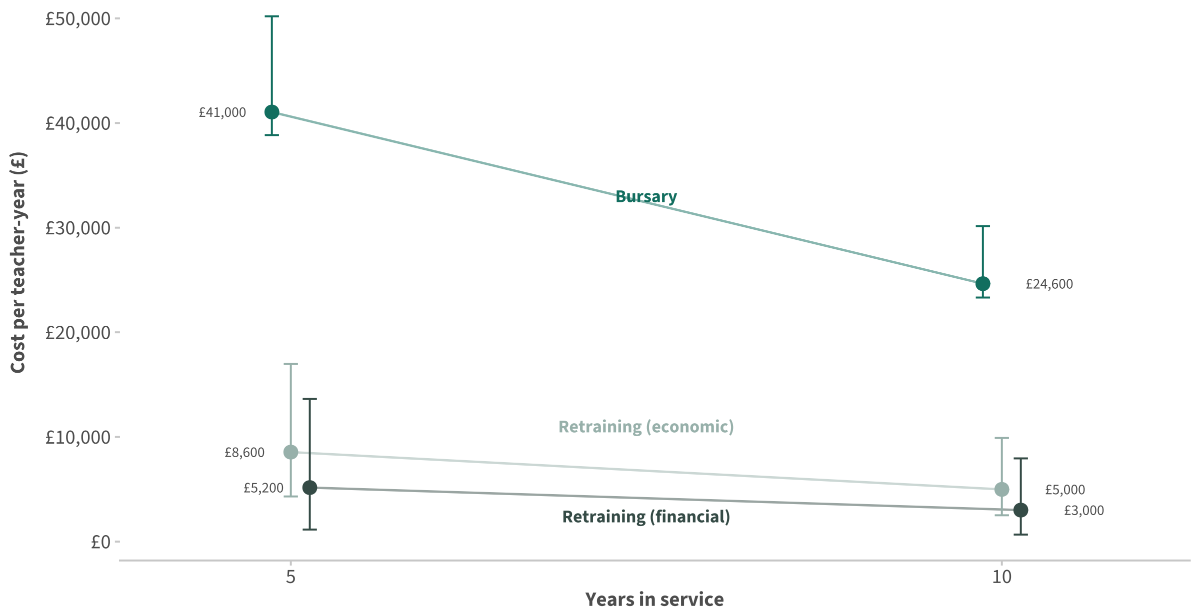
Comparison of the two routes

Retraining is cheaper per teacher-year than a bursary increase under most assumptions, largely because most bursary spending goes to teachers who would have trained anyway. This section presents the comparison in three ways. The first compares the cost per additional teacher-year at the margin, under both financial and economic costs. The second tests how far the equivalence ratio can fall before retraining ceases to be cost-effective (the break-even analysis). The third shows how many additional specialists a fixed budget would produce through each route.

Cost per teacher-year

The first comparison is on cost per additional teacher-year at the margin. Figure 9 compares the synthetic programme cost per teacher-year with the bursary cost per additional teacher-year. This is the raw cost of each route, with no adjustment for how effective a retrained teacher is relative to a degree-qualified specialist; that effectiveness question is handled separately by the break-even analysis that follows. The retraining cost is shown under both financial and economic scopes. Error bars show the range across the three retraining cost scenarios (varying programme intensity and bursaries) and the three bursary elasticity assumptions (18-34 per cent).

Figure 9: Retraining v bursary cost per teacher-year (£, 2024/25 prices). Raw cost with no equivalence adjustment. Retraining is shown under both financial and economic cost scopes. Error bars show the low- to high-cost scenario range for retraining and the low- to high-elasticity range for the bursary route.



On financial costs alone, all three retraining scenarios lie below the bursary cost at all time horizons. At the central estimate and 5-year horizon, the synthetic programme costs £5,200 per teacher-year, compared with £41,000 for a bursary increase. The gap widens at 10 years (£3,000 versus £24,600) because mid-career retrained teachers have higher annual retention rates than early-career bursary-route teachers, so they accumulate more teacher-years from the same upfront cost. These central estimates assume that completers continue teaching the target subject for the full horizon; the sensitivity analysis below relaxes this assumption.

Under economic costs, the retraining cost per teacher-year rises to £8,600 at the central estimate and 5-year horizon (£5,000 at 10 years), roughly double the financial cost, because teacher opportunity cost and net school cover are added. The bursary side is unchanged because its costs are entirely public expenditure with no comparable school-borne component. ITT trainees do bear an opportunity cost (one year of forgone earnings), but the bursary approximately compensates for this at current physics levels, so the financial and economic costs of the bursary route approximately coincide. Retraining remains cheaper under central assumptions, but the gap narrows. This matters for two reasons. First, schools deciding whether to release a teacher for retraining face the economic cost, not the financial cost, so the full resource cost is the relevant figure for programme take-up. Second, programme design choices that reduce time out of the classroom (shorter programmes, blended delivery, more self-study relative to contact hours) lower economic costs disproportionately because both teacher opportunity cost and school cover scale with contact hours.

Break-even equivalence ratio

The greatest source of uncertainty in the comparison is the equivalence ratio: how effective a retrained teacher is relative to a degree-qualified specialist. The cost comparison above sets that question aside and compares raw costs, but the routes are only directly comparable if a retrained teacher is as effective as a degree-qualified specialist, and no one knows the true value. Rather than assuming one, we can ask how low α would need to fall before retraining ceases to be cheaper per teacher-year than a bursary increase. The break-even α measures how large the bursary route's cost disadvantage is, not how effective a programme needs to be. Table 8 shows the break-even values under both financial and economic costs.

Table 8: Break-even equivalence ratio by cost scope, scenario, and time horizon

Cost scope	Scenario	5 years	10 years
Financial	Low cost	0.03	0.03
Economic	Low cost	0.11	0.10
Financial	Central	0.13	0.12
Economic	Central	0.21	0.20
Financial	High cost (SASP-like)	0.33	0.32
Economic	High cost (SASP-like)	0.41	0.40

Under financial costs, the break-even values are well below 1.0 across all scenarios and time horizons, meaning retraining remains cheaper even if retrained teachers are less effective than degree-qualified specialists. Under economic costs, the break-even α rises because the retraining cost per teacher-year is higher. At the central estimate and 5-year horizon, the break-even α moves from 0.13 (financial) to 0.21 (economic), narrowing further to 0.12 and 0.2 at 10 years. These are still well below 1.0, but the narrower economic margin means that a combination of low programme quality and high school-borne costs could erode the cost advantage. Programme designers should attend to the economic cost, not just the financial cost, when choosing programme intensity.

As discussed in the analytical approach, a low break-even α reflects the bursary route's large cost disadvantage, not a lenient standard for retraining quality. Break-even values of α below a minimum deployment threshold, the point at which a retrained teacher would not credibly be used as a specialist, are not practically meaningful. No evidence establishes where this threshold lies. The probabilistic sensitivity analysis in the next section presents results across the full range of α from 0 to 1.

Budget allocation scenarios

The third framing makes the marginal analysis concrete by asking how many additional physics specialists a fixed budget of public spending would produce through each route, using financial costs only (since the budget represents government expenditure rather than school-borne costs). Courses and delivery partners currently exist to provide SKPT, so a comparison on the basis of expanding either route is reasonable, though the estimates should be treated as illustrative because programme setup costs are excluded and per-unit costs at higher volumes are unknown.

We assume an illustrative additional £5 million for physics alone. For context, current physics bursary spending is approximately £32 million per year (1,095 entrants at £29,000 each), and the government's total financial incentives package across all subjects was £196 million in 2024/25.[54] On the bursary side, the budget funds a per-entrant increase paid to all 1,095 physics trainees. On the retraining side, it funds programme places at the central synthetic cost. Table 9 compares the two.

Table 9: What £5 million of additional spending produces: bursary increase v retraining (central estimates, physics)

	5 years	10 years
Bursary increase per entrant	£4,600	£4,600
Additional trainees attracted	145	145
Teachers in post at horizon	65	55
Cost per additional teacher-year	£42,600	£25,600
Retraining places funded	278	278
Retraining completers	236	236
Retrained teachers in post at horizon	200	170
Cost per teacher-year	£5,200	£3,000

At both time horizons, retraining produces more teachers in post from the same £5 million. The retraining column assumes constant cost per participant at all volumes. As noted in the cost breakdown section, some programme overhead is likely fixed, so the actual cost per participant at higher volumes could be lower than the central estimate. Against this, no national retraining programme has achieved its recruitment target: TSST reached 61 per cent of its 15,000 target over six years, and SKTM, a maths retraining programme, reached 57 per cent of its target in its first two

[54] Department for Education, '£196 Million to Support New Trainee Teachers', 2023.

years. Attracting participants at higher volumes would likely require additional investment in cover funding, stipends, or timetable flexibility that is not reflected in the cost estimates.

The two routes face different demand problems. The bursary route's cost is dominated by the inframarginal payment to existing entrants, which scales multiplicatively with cohort size. The retraining route instead faces per-participant barriers (cover costs, workload) that scale proportionally and can be targeted at participating schools. The limitations section discusses these demand constraints and their implications for the cost comparison in detail.

Non-cost differences between options

The cost comparison captures one dimension of the difference between policy options, but there are many other differences between the two. Table 10 summarises some of the differences that the quantitative analysis does not capture.

Table 10: Non-cost differences between retraining and bursary routes. Directions are the authors' assessment, not measured effects.

Dimension	Retraining	Bursary	Likely direction
Targeting	100 per cent of spend on new specialists	Mostly inframarginal payments to existing entrants	Favours retraining
Scope	Varies: KS3/KS4 (SKPT) to A-level (SASP)	Full specialist at all key stages	Favours bursary
Career stage	Mid-career, established	Newly qualified	Favours retraining
Teaching effectiveness	Mid-career teachers with steeper experience returns[55]	Early-career, still developing	Favours retraining
Retention	Higher annual retention (mid-career baseline)	Standard early-career trajectory	Favours retraining
Speed	Specialists within 1-4 terms depending on programme	2- to 3-year cycle from application to QTS	Favours retraining
Scalability	Limited by willing participants and capacity	Uses existing ITT providers, no new infrastructure needed	Favours bursary

The teaching effectiveness row deserves particular attention. Retrained teachers are mid-career practitioners who bring classroom experience that early-career teachers lack. Kraft and Papay found that returns to teaching experience are substantially larger in supportive professional environments, and that teacher effectiveness continues to grow well beyond the early career.[56] This advantage is not captured in the cost-per-teacher-year metric, which treats all teacher-years as equally valuable regardless of the teacher's experience.

In addition, the cost advantage identified above shows that retraining is typically cheaper at the scales observed. It does not follow that bursary spending should be redirected to retraining because the two routes serve different populations and operate at very different scales. The

[55] Kraft and Papay, 'Can Professional Environments in Schools Promote Teacher Development? Explaining Heterogeneity in Returns to Teaching Experience'.
[56] Kraft and Papay.

largest observed retraining throughput is approximately 1,800 teachers per year across all subjects (TSST), and SKPT reached approximately 380 physics teachers per year. Graduate recruitment through ITT alone produced 1,095 physics entrants in 2025/26. A programme that is cost-effective at the margin may not remain so at higher throughput, because the quality of delivery and the pool of willing participants may not scale proportionally. As noted in the budget scenarios, no national retraining programme has met its recruitment target. Neither TSST nor SKTM fully funded school cover costs, so it is unclear whether these shortfalls reflect a fundamental ceiling on demand or barriers that could be reduced with different programme design.

Sensitivity analysis

The comparisons above use best estimates for each input, but many of those estimates are uncertain. A different completion rate, a different elasticity, or a different delivery cost per hour could change the result. Rather than testing one input at a time, probabilistic sensitivity analysis (PSA) varies all uncertain inputs simultaneously.[57] Each uncertain input is assigned a plausible range based on the available evidence (listed in Table 11 below). A single simulation draws one value at random from each range, combines them into a complete set of assumptions, and re-runs the cost comparison. This is repeated 10,000 times, each time with a different random combination. Because the draws are independent, the simulations explore a wide range of possible assumptions, including combinations where several inputs are simultaneously unfavourable to retraining. If retraining is cheaper under most of those combinations, the conclusion does not depend on any single assumption being correct.

The analysis uses a 5-year horizon, the shorter and more conservative of the two comparison horizons. The equivalence ratio (α) is not drawn at random because it represents a judgement about programme quality rather than a measurable quantity. Instead, the results are presented for a range of α values.

Parameters

Table 11 lists the inputs that are varied, grouped by which side of the comparison they affect. On the retraining side, the main uncertainties are how much delivery costs per hour, how many hours the programme requires, and what proportion of participants complete. On the bursary side, the main uncertainties are how responsive trainee numbers are to bursary changes and how much TRIP payments add to the cost.

[57] Karl Claxton et al., 'Probabilistic Sensitivity Analysis for NICE Technology Assessment: Not an Optional Extra', *Health Economics* 14, no. 4 (2005): 339–47.

Table 11: Parameters varied in the sensitivity analysis, with ranges and distributions

Parameter	Range	Notes
Delivery cost per hour	£20–£60	Observed range across programmes
Contact hours	150–240	SKPT full programme to SASP contact hours
Completion rate	50–95 per cent	Wide range reflecting unknown SASP completion rate
Programme overhead	£1,500–£5,000	Admin, QA, coordination per participant
Cover bursary	£0–£15,000	No bursary to full agency cover (240hrs / 6.5hrs × £400/day)
Completion bonus	£0–£5,000	No bonus to SASP-level bonus
Subject retention	80–100 per cent	Annual probability of remaining in target subject; lower tail only (ceiling at 100%)
Bursary elasticity	10–40 per cent	NFER central 29 per cent; widened for extrapolation risk
TRIP annual payment	£0–£5,000	Depends on where marginal teachers are placed
ITT training cost	£22,000–£35,000	Allen et al. (2016) estimate; wide range reflects age of estimate
Bursary retention multiplier	0.90–1.10	Scales all bursary-arm annual retention rates; captures uncertainty about whether 2018–19 trajectory applies to future marginal entrants

All parameters are drawn independently but, in practice, some are likely to be correlated. For example, more contact hours tend to require specialist facilitators who cost more per hour, and completion bonuses may raise completion rates. Drawing them independently means the analysis modestly overstates how often extreme combinations occur, which could overstate confidence in the retraining route at low α values.

The bursary elasticity deserves particular note because it is the single most influential parameter. The NFER central estimate of 29 per cent was averaged across all subjects and the full £0-£30,000 bursary range from 2012-2021 data. Two features create uncertainty about its application here. First, physics at £29,000 sits at the top of that range, where each additional pound of bursary plausibly attracts fewer trainees than at lower levels. Second, the responsiveness varied across time periods: 7 per cent for 2012-15, 13 per cent for 2015-18, and 34 per cent for 2018-21. The sensitivity analysis uses a wide range (10-40 per cent) to reflect this extrapolation risk.

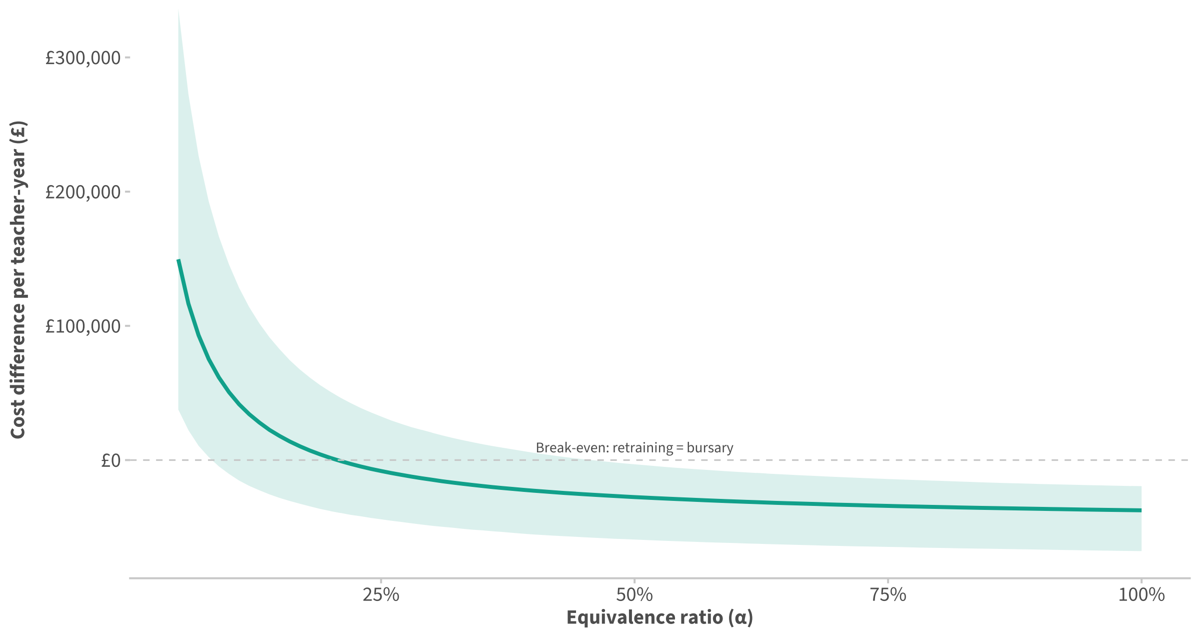
The number of physics ITT entrants does not affect the cost per additional teacher-year (as shown in the bursary marginal cost section, the inframarginal cost and additional trainees both scale with cohort size, so the per-unit ratio cancels) and is therefore not varied. Entrant numbers do matter for the budget scenarios and for the total fiscal cost of a bursary increase.

The NFER estimate is applied linearly: a £1,000 increase generates proportionally the same additional trainees regardless of the starting bursary level. The PSA bounds (10-40 per cent) are partly intended to capture non-linearity risk. The uniform distribution assigns equal weight across this range, reflecting genuine uncertainty about where the true elasticity lies at the current bursary level.

How the cost comparison changes

Figure 10 shows the cost difference (retraining minus bursary) at each assumed level of retrained-teacher effectiveness. Negative values mean retraining is cheaper. The solid line is the median across all 10,000 draws; the shaded band is the central 95 per cent of outcomes.

Figure 10: Cost difference (retraining minus bursary, £ per teacher-year) by equivalence ratio. Negative values mean retraining is cheaper. Shaded area is the 95 per cent interval across all draws.

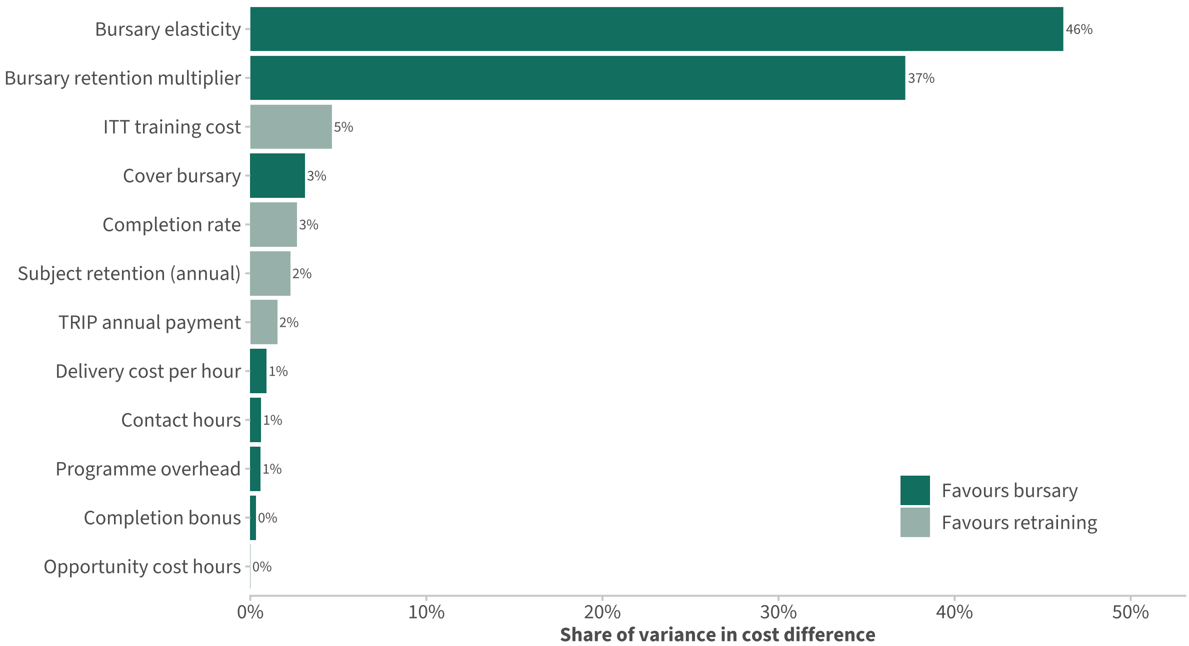


At $\alpha = 1$ (retrained teachers fully equivalent to specialists), retraining is cheaper by a median of £37,400 per teacher-year. The cost advantage narrows as α decreases because a less effective retrained teacher needs more teacher-years to match a specialist, raising the effective cost. The median break-even α is approximately 21 per cent: retrained teachers would need to be less effective than this before the bursary route became cheaper on average. Even at the 97.5th percentile (the top of the shaded band, representing the worst combination of assumptions for retraining), it remains cheaper down to α values below 0.25. An α that low would imply a retrained teacher contributes only a quarter of what a degree-qualified specialist does, well below any level at which a school would deploy them as a specialist. These extreme values illustrate the size of the cost margin, not a realistic quality threshold.

Which assumptions matter most

Not all inputs contribute equally to the uncertainty in the result. Figure 11 ranks them by how much each one matters. A long bar means that parameter is a major source of disagreement across the simulations: if it were known precisely, much of the uncertainty in the cost comparison would disappear. A short bar means the result is largely insensitive to that input, even though it was varied across a wide range. Formally, each bar shows that parameter's share of the total variance in the cost difference (the partial R^2 from a standardised regression of the cost difference on all sampled parameters).

Figure 11: Share of uncertainty in the cost difference attributable to each parameter



The largest source of uncertainty is how responsive trainee numbers are to bursary changes. On the retraining side, the completion rate and delivery cost per hour matter most, but far less than the bursary elasticity. The ranking partly reflects the width of the ranges assigned to each parameter. TRIP's large share, for example, reflects the wide £0-£5,000 range rather than the model being especially sensitive to TRIP payments. Parameters that rank highly on both range and model sensitivity are the ones where better evidence would most reduce uncertainty.

Limitations

Retraining has a lower estimated cost per teacher-year under most assumptions, but several gaps in the evidence base limit interpretation of the results.

Cost data and demand

The most consequential limitation is the paucity of evidence on programme delivery costs. Only one programme (SKPT) had detailed cost data available to us, and even that data did not separate fixed and variable components. Without that split, the analysis cannot estimate how per-participant costs would change at different scales. All retraining costs are modelled as constant per participant, which likely overstates costs at larger volumes (where fixed overheads are spread across more participants) and understates them at small volumes (where those overheads loom large). As noted in the cost framework, the bursary route incurs no comparable setup costs.

There is no evidence on demand for retraining. The analysis assumes willing participants exist at whatever volume the budget can fund, but the actual pool of teachers who would volunteer for or be nominated to a retraining programme is unknown. At larger scale, the composition of that pool would also shift: early participants in any programme tend to be willing volunteers with intrinsic motivation, but scaling up may require recruiting teachers who are less enthusiastic about changing subjects, potentially raising dropout rates and programme costs. As the budget scenarios section notes, no national retraining programme has achieved its recruitment target, but how binding this constraint would be under different programme designs is unknown. What direct evidence exists points to release from class, rather than reluctance, as the main constraint in current provision. SKPT participants report time out of school as the main barrier to completing further modules, and the number returning for more is rising. That evidence speaks to teachers already enrolled, not to how many would come forward at much larger scale. Whether reaching that scale would require financial incentives to recruit beyond the willing, as bursaries did for graduate recruitment, is untested; if it did, the cost of retraining would rise accordingly.

This demand gap does not, however, undermine the per-unit cost comparison. The retraining route's costs (cover, workload) are per-participant and can be targeted at participating schools, unlike a bursary increase where the inframarginal payment to existing entrants dominates. Even if the government fully funded cover at £400 per day (the upper end for agency supply in London), the cost per participant would rise but remain well below the bursary route's marginal cost per additional teacher-year.

The sensitivity analysis encompasses this scenario, with probabilistic draws that include cover bursaries up to the equivalent of full agency cover for the most intensive programme duration.

Furthermore, the demand constraint is not only a question of volume. In the 2024 Working Lives of Teachers and Leaders survey, 68 per cent of teachers cited a lack of time due to high workload or competing priorities as a barrier to professional development, the most frequently reported barrier.[58]

These constraints would apply with particular force to intensive retraining programmes that require sustained time away from school. SASP's 40-day model, for example, would cost schools £12,000 per participant in supply cover alone at the central daily rate, where not reimbursed. If programmes struggle to fill places, the per-unit cost would also rise as fixed overhead is spread over fewer participants and stronger incentives are needed to attract reluctant teachers. The cost comparison holds at the volumes assumed in this analysis, but the evidence gap is how many teachers can realistically be retrained at any given budget level. Answering it would need evidence on take-up that existing programmes have not collected, whether from a piloted programme or from variation in current provision.

Because retraining develops teachers already employed in schools, it could in principle reach schools that struggle to recruit specialists on the open market, where a bursary-funded new entrant may never apply. No participant-level data identify which schools take up these programmes, so this potential distributional advantage is unconfirmed. The opposite may hold: take-up could be higher in schools with enough slack to release a teacher for training than in the most understaffed schools, where losing a teacher to professional development is hardest. That is the same release constraint identified in the SKPT data, and if it dominates, retraining would not automatically reach the schools with the greatest need.

Bursary route assumptions

The cost advantage of retraining depends heavily on the bursary being a uniform increase paid to all entrants. If bursaries could be targeted more precisely at marginal entrants, the inframarginal cost would fall and the gap would narrow. Targeting is difficult in practice because the government cannot easily identify who is marginal at the point of application, but it is not impossible. TRIP already targets retention payments by geography and school type. The analysis compares retraining against the bursary route as currently designed, not against an improved alternative.

This is a cross-sectional cost comparison, not a causal evaluation. It cannot estimate what would happen to teacher supply or quality if either route were scaled up, nor can it account for general equilibrium effects such as changes in schools' hiring or timetabling behaviour.

Outcomes, quality, and generalisability

Whether retrained teachers continue teaching the target subject remains the most consequential untested assumption. In English science, however, the concept of "reversion" is more complex than a simple binary. Most science teachers already teach across more than one science subject, so the question is not only whether a retrained teacher switches back entirely but whether they teach the target subject confidently at KS3/KS4 or go on to teach it at A-level. A retrained teacher who works more confidently across physics and their original subject represents a different kind of

[58] Department for Education, 'Working Lives of Teachers and Leaders: Wave 3 Research Report' (Department for Education, June 2025).

gain from a fully specialist A-level physicist, and one that the equivalence ratio is designed to capture. The only longitudinal evidence is the Sani and Burghes study described in the evidence review, which implies an annual subject-attrition rate of roughly 21 per cent.[59] The sensitivity analysis varies this rate from 0 to 20 per cent per year to encompass the Sani finding, though their sample of eight assigned (not volunteer) teachers may not generalise to longer, more intensive, voluntary programmes.

The Rutgers evidence review found that retrained teachers may "inhabit a space between in- and out-of-field," but no study has compared classroom effectiveness using pupil outcomes, so α remains unmeasured.[60] The break-even approach shows what α must be, not what it is.

How far each programme moves teachers also depends on where they start, and no data record the subject knowledge that participants brought to SASP or SKPT before beginning. Two completers reaching the same standard may have started from very different baselines, so a programme that admits teachers already close to specialist level would post stronger outcomes while adding less. This leaves α harder to interpret still, because the break-even ratio compares a completer with a newly recruited specialist without knowing how far either programme actually closed the gap.

The composition of ITT entrants has changed since the bursary elasticity was estimated. In 2025/26, 63 per cent of physics ITT entrants are international,[61] whereas the NFER retention trajectories were estimated from predominantly domestic 2012-2021 cohorts. If international recruits are retained at lower rates than domestic entrants, fewer of them would still be teaching at each horizon, raising the bursary cost per additional teacher-year. If they are retained at higher rates, the cost would fall. No retention data disaggregated by nationality are available to test either direction.

As noted in the bursary marginal cost section, the cost per additional teacher-year is invariant to cohort size under the NFER semi-elasticity. If, however, the pool of marginal entrants is roughly fixed in absolute terms, meaning there is a finite number of potential physics teachers who could be tipped into training regardless of how many already enrol, then the cost per additional teacher-year would rise with cohort size. Under that alternative assumption, the historically high 2025/26 intake would make the bursary route more expensive than the model estimates.

Retrained physics teachers were previously teaching another subject. This analysis counts the gain to physics but does not account for any loss to the source subject. For teachers drawn from overrecruiting subjects (physical education at 204 per cent of target, biology at 153 per cent), this trade-off is likely small. For teachers drawn from subjects near target, the net system benefit would be smaller than the physics-only gain implies. Chemistry teachers are arguably the most likely candidates for physics retraining, given the overlap in subject knowledge, but chemistry

[59] Sani and Burghes, 'Longitudinal Study of "Retraining" Non-Maths Specialist Teachers to Become Capable, Confident Teachers of Mathematics'.
[60] Rutgers et al., 'Understanding Subject Specific Professional Development for Out-of-Field Teachers'.
[61] Department for Education, 'Initial Teacher Training Census, Academic Year 2025/26'.

itself is a shortage subject (at 75 per cent of its 2025/26 recruitment target), so retraining chemistry teachers for physics could exacerbate one shortage while alleviating another.

As noted in the analytical approach, the calculations use physics-specific parameters. Subjects with lower bursaries or fewer existing entrants would show a smaller inframarginal cost, narrowing the gap between routes. Whether retraining programmes exist or could be developed for other shortage subjects (computing, design and technology) is an open question.

Recommendations for government

The analysis points to three actions for government that would either produce specialist teachers more cost-effectively or close the evidence gaps that limit current estimates. The second would be taken forward with research organisations.

Fund a specialist-equivalent retraining programme

If the government's objective is to increase the specialist workforce cost-effectively, funding at least one programme designed to train non-specialist teachers to A-level depth in physics or maths would be a lower-cost route than a further bursary increase under most plausible assumptions about programme quality. No programme currently trains to A-level depth, and since 2016/17 the proportion of lessons taught by teachers with a relevant degree in disadvantaged secondary schools has fallen by 11 percentage points, from 58 to 47 per cent.[62] SASP is the only programme in the past 20 years to have done so, and the only one for which any long-term follow-up of participants has been attempted, though the sample was small ($n = 19$) and self-selected. A new programme at this depth would provide the most informative cohort for future cost-effectiveness evaluation, and should have completion tracking and independent evaluation built in from the start.

The PDMT in Ireland, described in the evidence review, shows what a sustained government-funded retraining programme can achieve at national scale. A modern programme in England could follow a similar blended model of online content and face-to-face pedagogy, reducing time out of classroom relative to SASP's 40-day residential model, though this may also affect completions.

Five design features will need attention:

1. **Participation barriers.** Past programmes have fallen short of recruitment targets even with central funding, so programme design must address participation barriers, especially cover costs and workload constraints, alongside content and pedagogy. Evidence from the current SKPT programme identifies release from school, rather than participant willingness or programme design, as the primary constraint on completing modules, so a programme delivered at scale would need to fund release time and not only curriculum delivery.
2. **Post-completion support.** Sani and Burghes's finding that retrained teachers can revert to their original subject suggests that programme design should include structured post-completion support such as subject-specific mentoring, collaborative planning groups, or both.[63]

[62] Cardim Dias, Jiménez, and Zuccollo, 'Closing the Workforce Quality Gap'.
[63] Sani and Burghes, 'Longitudinal Study of "Retraining" Non-Maths Specialist Teachers to Become Capable, Confident Teachers of Mathematics'.

3. **Facilitator pipeline.** Perry et al.'s finding that the quality and credibility of programme facilitators was central to SASP participants' experience means that scaling any new programme requires a pipeline of credible subject-expert facilitators.[64]
4. **University partnerships.** The Rutgers review found that university-based facilitators featured in the majority of effective programmes internationally, but what makes those collaborations effective remains unexplored.[65] The facilitator supply constraint may bind before participant recruitment or funding limits, although the system has demonstrated capacity to scale facilitated programmes: the Early Career Framework and National Professional Qualifications both rely on subject-specialist facilitators and have been rolled out nationally.
5. **TRIP eligibility.** The government could consider extending TRIP eligibility to teachers who complete a retraining programme in a shortage subject. TRIP currently requires ITT in the subject or a relevant degree, excluding retrained teachers.[66] Extending eligibility would reduce the financial asymmetry between routes and strengthen incentives for teachers to undertake retraining.

Close the data gaps on completion, post-programme teaching, and demand

Any funded retraining programme should be required to track completion rates against a pre-defined standard and to link participant records to the School Workforce Census so that it is possible to measure whether completers continue teaching the target subject and whether they later return to their original subject. As the limitations section documents, these are the two largest data gaps in the cost evidence base and both can be closed if the commitment to collect the data is built into programme design from the start.

A further gap sits upstream of any programme. How many teachers would be willing to retrain, and what would encourage them to, is not known, and could be established now by surveying serving teachers, independently of whether a programme is funded. Such a survey would also show whether reaching larger scale would require financial incentives beyond funded release, the assumption the cost comparison cannot currently test.

Add retraining alongside bursary policy, not in place of it

Expanding retraining capacity is likely cost-effective, but that is not a reason to reduce bursary spending. The physics bursary at £29,000 already exceeds median graduate earnings one year after graduation, yet successive increases have not closed the gap in specialist teaching: more than a quarter of physics teaching hours are still delivered by teachers without a relevant post-A-level qualification,[67] and the recent recovery in recruitment has tracked the graduate labour market and overseas entrants rather than the bursary. Further increases face diminishing returns not because the elasticity is declining (the NFER evidence does not show this within the observed range) but because each increment must be paid to all entrants. Retraining reaches mid-career

[64] Perry, Hartley, and de Winter, 'A Scoping Study into the Long-Term Impacts of Additional Subject Specialism Professional Development'.
[65] Rutgers et al., 'Understanding Subject Specific Professional Development for Out-of-Field Teachers'.
[66] Department for Education, 'Targeted Retention Incentive Payments for School Teachers'.
[67] Department for Education, 'School Workforce in England'.

teachers already in post, while bursaries attract new graduates into the profession, and both are needed to close the shortage. At the current scale (approximately 380 physics teachers per year through SKPT, or 1,800 across all subjects through TSST), retraining cannot substitute for graduate recruitment through ITT, which produced 1,095 physics entrants in 2025/26 and 522 per year on average over the preceding six years.

Scale in retraining is also challenging to achieve because participation is voluntary, and as noted above, every programme with a recruitment target has fallen short. The external evidence on CPD barriers suggests these shortfalls reflect sector-wide constraints (workload, cover costs, declining CPD budgets) rather than programme-specific failures.[68] Ireland's PDMT succeeded partly because the Teaching Council's qualification requirements created institutional demand for retraining that England's voluntary model lacks.[69] Complementary investment in reducing participation barriers, such as fully funded cover, may be needed alongside the programme itself.

[68] Department for Education, 'Working Lives of Teachers and Leaders'.
[69] Rutgers et al., 'Understanding Subject Specific Professional Development for Out-of-Field Teachers'.

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