



Retaining, Recruiting, and Retraining Physics Teachers for Scotland's Future

Institute of Physics Scotland

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Foreword

Physics teachers don’t just teach a subject; they open pupils’ eyes to the wonders of the world and possibilities of the future. They are unlocking the potential of the next generation of Scottish innovators, and so are a crucial first element in building our future economy.

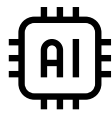
Scotland, rightly in our view, insists on subject registration of teachers, meaning permanent positions must be filled by qualified subject teachers to maintain teaching quality. Subject specialist teachers are uniquely well placed to identify and correct pupil misconceptions and errors, and to connect theory to the real world. Specialist teaching nurtures pupil confidence and depth of understanding, fosters higher attainment and encourages progress to further study and careers.

However, there is a severe shortage of physics teachers compared with national needs. Physics teachers drop out at a higher rate when compared with teachers of other subjects, in part because of the more competitive market for physics skills outside of teaching, but also because of aspects of school culture, lack of autonomy and of career development opportunities. Shortfalls occur at higher rates in rural areas and schools in less affluent communities. This manifests itself in several ways which inhibit good teaching and good learner outcomes: temporary posts, multi-course teaching, distance learning, and course closures, especially in rural areas and deprived communities where gaps more frequently occur.

Multi-course teaching, where pupils studying different courses such as National 5 Physics and Higher Physics are taught simultaneously in the same class, leads to a fragmented learning environment, with pupils having to teach themselves via textbooks, online sources, or videos for large portions of class time while sharing their teacher’s attention with others. This can contribute more distraction for pupils, disrupted practical work, slow pacing for advanced pupils, reduced help for those with additional support needs, teacher burnout and low teacher morale, and fewer pupils continuing with the subject. This widens inequality of access and starves the skills pipeline.

We believe that Scotland can be at the forefront of the fourth industrial revolution that we are entering, driven by quantum, photonics, robotics, and AI. That we can be a true innovation nation where our universities and research base are recognised around the world as elite; and that we can be leaders in tackling climate change, the energy transition, and modern, personalised medicine. But fulfilling this ambition will only happen if we get our education system right and can effectively teach our young people about the physical world. This report sets out the scale of the challenges for physics teaching in Scotland, and what we can and must do to meet those challenges.

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Dr Karen Haughian
 Chair, IOP Scotland Committee



Dr Judith Hillier
 Vice-President
 (Learning & Skills), IOP

Executive summary and recommendations

Physics is fundamental to Scotland’s future prosperity, resilience, and wellbeing. It underpins many of the sectors that will drive economic growth in the coming decades, including renewable energy, advanced manufacturing, space technologies, photonics, semiconductors, quantum technologies, artificial intelligence, and healthcare. Achieving Scotland’s ambitions for net zero, innovation, productivity and inclusive economic growth will depend upon a workforce with strong physics knowledge and skills. Developing that workforce begins in schools.

High-quality physics teaching gives young people access to powerful knowledge about the physical world. It develops analytical thinking, problem-solving ability, mathematical reasoning, and scientific literacy. It enables pupils to progress into further study and careers in science, engineering, and technology. But even for pupils who don’t pursue physics as a subject beyond secondary school, it helps them participate in a society increasingly shaped by technological change. Yet Scotland faces a growing shortage of physics teachers.

This report finds that the number of physics teachers in Scotland has fallen over the past two decades and continues to decline. Recruitment into initial teacher education (ITE) has fallen far below national requirements for several consecutive years, while many experienced teachers are approaching retirement or leaving the profession early. At the same time, demand for physics skills across the economy is increasing. The consequences are already being felt in schools.

Physics teacher shortages are reducing educational opportunities for young Scots, particularly in rural areas and communities experiencing socioeconomic disadvantage. Schools are increasingly relying on temporary staff, multi-course teaching, out-of-specialism teaching, consortium arrangements, and other coping mechanisms to maintain provision. In some cases, Higher and Advanced Higher courses have been reduced or withdrawn altogether.

These pressures create significant challenges for both pupils and teachers. Where staffing levels are insufficient, pupils receive less specialist support, practical work becomes more difficult to deliver, and progression routes can narrow. Multi-course teaching requires teachers to divide their attention between different qualification levels simultaneously, often forcing pupils to work independently for substantial periods. This can disadvantage pupils who require additional support and contribute to lower confidence, attainment, and continuation rates.

The burden on teachers is equally significant. Physics teachers frequently work in small departments or as lone specialists, particularly in rural schools. They face high workload demands and limited opportunities for career progression, increasing administrative pressures and many report professional isolation and a lack of recognition for specialist expertise.

The evidence set-out in this report suggests that retention has become the most urgent challenge facing the physics teaching workforce. Recruiting new teachers remains essential, but the fastest and most cost-effective way to strengthen the workforce is to keep experienced teachers in classrooms. Every teacher who leaves takes with them not only subject expertise but also mentoring capacity, leadership, curriculum knowledge, and professional experience.

Research indicates that teachers leave for a combination of reasons rather than a single factor. Key drivers include limited career progression, excessive workload, insufficient flexibility, and concerns about school leadership, behaviour management, and accountability systems. More so than for many other subjects, physics teachers also have access to attractive alternative careers beyond education, increasing the risk of attrition.

Alongside retention challenges, Scotland’s recruitment pipeline is under severe strain. Physics has consistently recorded some of the lowest recruitment rates of any secondary teaching subject. In recent years, recruitment has achieved less than one-third of the national target despite rising workforce need. Without intervention, these shortfalls will continue to accumulate and place further pressure on existing staff.

The report identifies a range of factors contributing to poor recruitment. These include stronger financial incentives elsewhere in the labour market, limited awareness of or preparation for teaching among physics undergraduates, concerns about workload, and a perception that teaching offers fewer opportunities for professional development and career progression than alternative careers in physics. Addressing these challenges requires a long-term and co-ordinated response. The Institute of Physics Scotland recommends that the Scottish Government, local authorities, universities, schools, and national agencies work together to develop and implement a ten-year strategy for physics teacher workforce sustainability. The strategy should place retention at its centre while also strengthening recruitment and expanding opportunities for retraining and subject conversion.

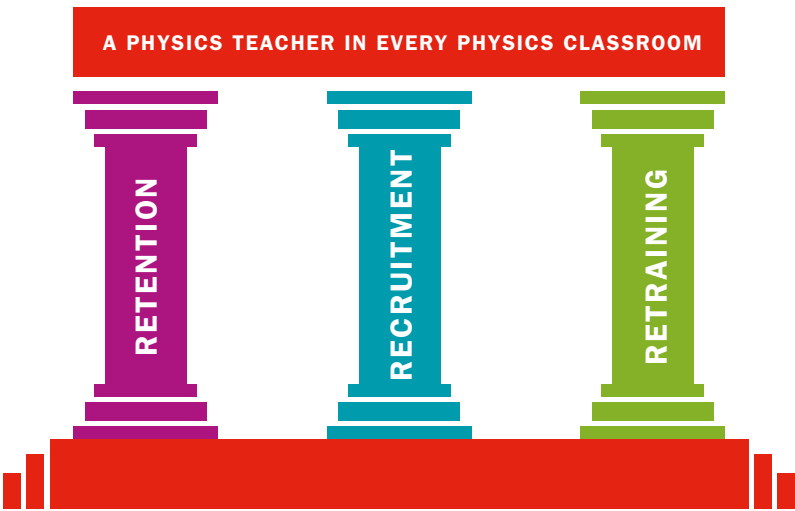


Figure 1. The pillars of improvement.

Key priorities should include:

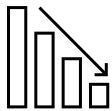
- Creating stronger career pathways that allow teachers to progress while remaining focused on classroom practice and subject expertise.
- Expanding flexible working opportunities, including part-time working, job sharing, and phased retirement.
- Reducing unnecessary workload and administrative burdens.
- Strengthening support for positive behaviour and classroom management.
- Increasing access to high-quality subject-specific professional learning.
- Improving provision of science technicians and laboratory resources.
- Reducing reliance on multi-course teaching.
- Collecting better workforce data, including information on teacher attrition and out-of-specialism teaching.
- Improving recruitment into physics teacher education through targeted incentives, promotion, and support.
- Expanding opportunities for qualified teachers and physics graduates to retrain into physics teaching.

The challenge is significant, but it is not insurmountable. Scotland has world-class universities, internationally recognised research strengths, and a growing need for physics-based skills across its economy. However, the foundations of that success are laid in schools. Without enough specialist physics teachers, Scotland risks constraining educational opportunity, weakening the skills pipeline, and undermining future economic growth.

Physics teacher shortages are therefore not simply an education workforce issue. They are an issue of national capability, economic competitiveness, and social equity.

The decisions taken over the next decade will determine whether Scotland can build the skilled workforce required for the industries of the future. A sustained commitment to retaining, recruiting, and retraining physics teachers is essential if Scotland is to realise its ambitions as a leading science, technology, and innovation nation.

Without enough physics teachers, Scotland risks constraining educational opportunity, weakening the skills pipeline, and undermining future economic growth.



Recommendations

The ten-year strategy should consider each of the following elements:

Retention

1. Review the faculty model in Scottish schools and its impact, with an ambition to ensure dedicated subject-specific leadership and mentoring capacity and formal recognition for classroom-focused promotion paths
2. Formal, consistent national guidelines for schools to offer flexible working options such as jobsharing, part-time roles, and phased retirement
3. Ring-fence local authority budgets dedicated to the routine replenishment and replacement of classroom physics and science equipment
4. Mandate minimum science technician support hours per physics department to alleviate logistical and administrative burdens on teaching staff
5. Address and reduce demands on teachers to carry out avoidable administrative and bureaucratic tasks such as data entry
6. Support and resource the implementation of systemic, clear, and consistent positive behaviour strategies ensuring teachers are supported and not isolated when facing pupil disruption
7. Collect national data for Scottish education to drive informed improvement and workforce planning, including monitoring and publishing the exact extent of out-of-specialism teaching across all secondary schools, routine leaver interviews for those exiting the profession, and surveys of all teachers in each of their first five years to capture and act upon pressures which drive attrition
8. Cut multi-course teaching by half by 2031
9. Develop high-quality subject specific professional learning to ensure that an entitlement to 50% of their professional learning (during personal professional development and collegiate time) being subject-specific, can be delivered
10. Enhance subject-specific career-long professional learning for non-specialist teachers who teach physics during the Broad General Education phase
11. Review how salary, conditions of service, and career pathways for teachers in shortage subjects can be improved to ensure teaching is an appealing career option

Recruitment

12. Commission a comprehensive research study into the low throughput from physics undergraduates into teaching
13. Reform the teaching bursary by broadening eligibility criteria, at least matching its value to England's, and align timings with the ITE recruitment cycle

14. Enhance teaching bursaries specifically for subjects experiencing the most acute shortages, and in particular shift the preference waiver into a staged retention premium spread over the first five years post-qualification

15. Create transitional financial protections for career changers

16. Change the funding model for universities to ensure there is viable provision for ITE in shortage subjects in all areas of Scotland

17. Provide subject-specific support for career-changing recruits, including Subject Knowledge Enhancement courses

Retraining

18. Develop courses to enhance teachers' subject and pedagogical knowledge in physics to support teachers already qualified in other subjects to meet the GTCS Additional Registration requirement for physics
19. Ring-fence time to allow teachers already qualified in other subjects to retrain in an additional subject
20. Flexible timetabling arrangements to allow teachers in technology, engineering, and maths subjects to teach physics without an expectation to teach biology and chemistry in BGE to better utilise their expertise

System Foundations

21. Collect improved data on teacher vacancies, those teaching outside their specialism, and the teachers needed to deliver the curriculum required by wider national policy and future demands
22. Improve collaboration and policy alignment between all agencies with a role in teacher retention, recruitment, retraining, employment, and workforce planning
23. Training and protected time for teacher mentors to help ensure those recruited and retrained are then retained and developed
24. Collect robust, long-term evidence linking school physics provision to pupil destinations, regional skills demand, and national policy needs; closing this gap is crucial for effectively targeting policy interventions



Section 1: A Ten-Year Plan

1.1 Physics and society

“Physics is concerned with the smallest things we can conceive, and the largest, and everything in between; from the behaviour of individual electrons to galaxies containing millions of stars, not to mention the nature of time and even how social networks develop.”¹

Physics plays a pivotal role in supporting Scotland’s economic, environmental, and social goals. Key sectors are heavily reliant on physics, including energy generation and transmission (oil, gas, and renewables), net-zero technologies, advanced manufacturing, space and satellite systems, semiconductors, photonics, and emerging quantum technologies, as reflected in the Critical Technologies Supercluster.²

Scottish Government initiatives recognise this: the Climate Emergency Skills Action Plan³ details substantial needs for physics skills to achieve Scotland’s 2045 net-zero target, while almost all growth areas identified in the National Innovation Strategy⁴ are driven by physics. Furthermore, developments in health, transport, defence, and planning rely significantly on physics principles and their application.

Each of these areas depends on people with strong analytical skills, quantitative reasoning, and a deep understanding of physics. Schools are a critical pipeline for this capability; high-quality physics education enables young people to acquire foundational knowledge and skills, progress to advanced study, and access technical careers, whereas weak provision limits individual opportunity and constrains national capacity.

The benefits of dedicated science teaching extend beyond the STEM pipeline, ensuring that pupils who do not pursue STEM careers can still participate successfully in a society dominated by technological issues.⁵ Additionally, science learning, and physics learning specifically, develops highly valued skills by strengthening inductive reasoning, hypothesis testing, and evidence evaluation.⁶ These cognitive skills prepare learners for intellectual challenges beyond the sciences.

1.2 The role of high-quality, specialist teaching

Evidence from across the UK shows that access to high-quality, specialist physics teaching matters. Teachers with strong subject knowledge typically have more passion for the subject and convey this to their pupils. More significantly, they better explain abstract concepts, anticipate misconceptions, lead effective practical work, and build pupil confidence.

Physics especially benefits from specialists who can make abstract concepts come alive. Understanding physics topics such as waves, energy, forces, and states of matter is often counter-intuitive and challenges everyday perceptions. Specialist teachers more easily excel in providing the clear explanations, skilled questioning, and regular engagement to promote higher-order thinking skills.⁷

¹ Chapter 1.1 “What Is Physics?” in *Teaching Secondary Physics*, 3rd edn, (2021), de Winter and Hardman (eds) (Association for Science Education)

² See <https://techsupercluster.scot/>

³ See www.skillsdevelopmentscotland.co.uk/media/w0ulewun/climate-emergency-skills-action-plan-2020-2025.pdf

⁴ See www.gov.scot/publications/scotlands-national-innovation-strategy/

⁵ see e.g. *Why We Teach Science: (and Why We Should)*, Rudolph (2019) (OUP)

⁶ *Thinking Science: The Curriculum Materials of the Cognitive Acceleration Through Science Education (CASE) Project*, Adey, Shayer and Yates (2nd edn, 2003) (Macmillan)

⁷ See “Quality of Teaching” section within indicator 2.3 (Learning, Teaching and Assessment) in the Scottish inspection framework, *How Good Is Our School* (4th edn, 2015) (Education Scotland): see <https://educationinspectorate.gov.scot/inspection-frameworks/hgios4/>

A strong positive correlation has been demonstrated between teacher pedagogical knowledge (i.e. the theory, practice and methods of learning) in their subject and the outcomes of pupils.⁸ Without specialist teaching, pupils, particularly those in schools serving disadvantaged communities with fewer alternative sources of support, are less likely to progress beyond initial study to Higher and Advanced Higher levels.

The value of specialist teaching is strongly allied to structured, knowledge-based curriculum models. Specialist teachers with a good understanding of cognitive science and effective teaching strategies are best placed to support effective learning.⁹ As Scotland develops a more knowledge-rich curriculum following the 2021 OECD review,¹⁰ specialists can best help pupils integrate scientific content with guided inquiry methods to deepen understanding.

Finally, while Scotland’s curriculum encourages interdisciplinary learning on issues like sustainability and digital skills, this does not remove the need for deep subject expertise. Interdisciplinarity depends entirely on strong disciplinary foundations:

“Interdisciplinary working requires that all science subjects should continue to be founded on deep and coherent pillars of knowledge and understanding. Interdisciplinary understanding will lack rigour and utility if it is not part of a structure in which the disciplines are pillars with interdisciplinary work as lintels. Without the pillars, the lintels will fall.”¹¹

1.3 Access, geography, and equity

Physics teacher shortages do not affect all schools and all pupils equally.

Evidence indicates that rural, island and remote schools face persistent recruitment difficulties. Smaller departments are more vulnerable to loss of provision following a single departure or staff absence, and schools serving more deprived communities often have fewer physics teachers per pupil.¹² These factors combine to limit access to advanced physics courses in precisely the locations where education can play the greatest role in improving life chances.

Limited access to physics education contributes to lower progression within schools, reduced participation by girls and young women in higher education in physics-related subjects,¹³ and weaker local skills pipelines. The IOP considers this to be a direct challenge to educational equity as well as workforce planning.

1.4 The wider skills pipeline

Physics teacher shortages impact more than just educational attainment, as physics-powered industries increasingly struggle to recruit skilled staff. Scotland has the UK’s highest concentration of physics-based roles, 16% above the UK average, making the subject vital to our prosperity and productivity.¹⁴ This workforce centres on advanced manufacturing, space technology, photonics, and the green industrial revolution. As Scotland transitions from traditional industries, physics R&D fuels high-tech growth sectors like quantum computing, where high-skill roles grow the fastest.

Yet, the IOP’s *Paradigm Shift* survey revealed that 70% of innovating physics businesses in Scotland delayed or shelved R&D investment due to skills shortages.¹⁵ “Hard-to-fill” vacancies are common, especially for roles blending technical physics with digital and data skills.

While nearly half of physics-demanding jobs require intermediate qualifications like apprenticeships, UK education and skills systems fail to provide the pathways or personnel to support young people into these high-value careers.¹⁶ Weak local pipelines mean higher costs, project delays, and reduced investment incentives for employers.

In a post-Brexit market with tighter migration and intense global competition, Scotland cannot simply import physics professionals to plug skills gaps; strengthening domestic skills is essential. Scotland lacks robust, long-term evidence linking school physics provision to pupil destinations, regional skills demand, and national policy needs. Closing this data gap is crucial for effectively targeting policy interventions.

IOP’s *Paradigm Shift* survey revealed that 70% of innovating physics businesses in Scotland delayed or shelved R&D investment due to skills shortages



⁸ Chapter 1 in Results from the Teacher Knowledge Survey: What Teachers Know About General Pedagogy, TALIS, OECD (2026), at www.oecd.org/content/dam/oecd/en/publications/reports/2026/04/results-from-the-teacher-knowledge-survey_eebdccc11/5542e88a-en.pdf, and “Can Professional Environments in Schools Promote Teacher Development Explaining Heterogeneity in Returns to Teaching Experience”, Kraft and Papay, Educational Evaluation and Policy Analysis (2014) 36(4), at www.researchgate.net/publication/269469249_Can_Professional_Environments_in_Schools_Promote_Teacher_Development_Explaining_Heterogeneity_in_Returns_to_Teaching_Experience

⁹ See “Principles of Instruction: research-based strategies that all teachers should know”, Rosenshine, in American Educator (2012) pp 12–19 and 39; see www.aft.org/sites/default/files/Rosenshine.pdf

¹⁰ “Scotland should consider updates to some of its vision’s core elements and their implications for practice, in particular, the role of knowledge in CfE”, in Recommendations for Next Steps (at page 13) in Scotland’s Curriculum for Excellence: Into the Future, OECD (2021), at www.oecd.org/content/dam/oecd/en/publications/reports/2021/06/scotland-s-curriculum-for-excellence_9de88365/bf624417-en.pdf

¹¹ Pillars and Lintels: The Whats, Whys and Hows of Interdisciplinary Learning, Royal Society of Edinburgh (2017), at <https://rse.org.uk/pillars-lintels-interdisciplinary-learning/>

¹² See later in this report for details of FOI requests of Scotland’s local authorities by IOP Scotland, and also Subject Shortages in Scottish Secondary Education, SLS (2025), at www.sls-scotland.org.uk/wp-content/uploads/2025/06/SLS-Survey-on-Shortage-Subjects-Report-May-2025.pdf; “Every secondary hit by teacher shortage, says education director”, Emma Seith (21 November 2023), in Times Educational Supplement Scotland, at www.tes.com/magazine/news/secondary/teacher-shortage-recruitment-scotland-action; and “Voice and influence in Scottish education policy: Whose interests? Whose power? Whose system?”, Beck, Simpson and Campbell (2024), presentation to Scottish Educational Research Association conference (2024).

¹³ See Girls in the Physics Classroom: A Review of the Research on the Participation of Girls in Physics, Murphy and Whitelegg (2006) (Institute of Physics), at www.iop.org/sites/default/files/2019-04/girls-in-the-physics-classroom.pdf.

¹⁴ Physics in Demand: Labour Market Skills in the UK and Ireland, IOP (2022), at www.iop.org/sites/default/files/2022-01/Physics-in-demand-labour-market-skills-uk-and-ireland.pdf.

¹⁵ Paradigm Shift: Unlocking the power of physics innovation for a new industrial era, CBI Economics (2021) (IOP), at www.iop.org/strategy/productivity-programme/drivers-physics-innovation/paradigm-shift-uk

¹⁶ Solving Skills: Powering growth through physics-related apprenticeships, IOP (2023), at www.iop.org/about/publications/solving-skills.

1.5 Effects on universities

Between 2013-14 and 2022-23, physics graduate numbers in Scotland grew by 2.1% annually (an extra 24 graduates per year), showing advanced physics learning remains popular. However, engineering and technology remain far more popular, drawing significantly more Scottish university students than pure physics¹⁷ yet both these subjects are also reliant on high-quality physics teaching in secondary school, and graduates from these disciplines also contribute to the physics-powered economy in Scotland. However, physics graduates have a distinct skill set, for which there is a distinct need.

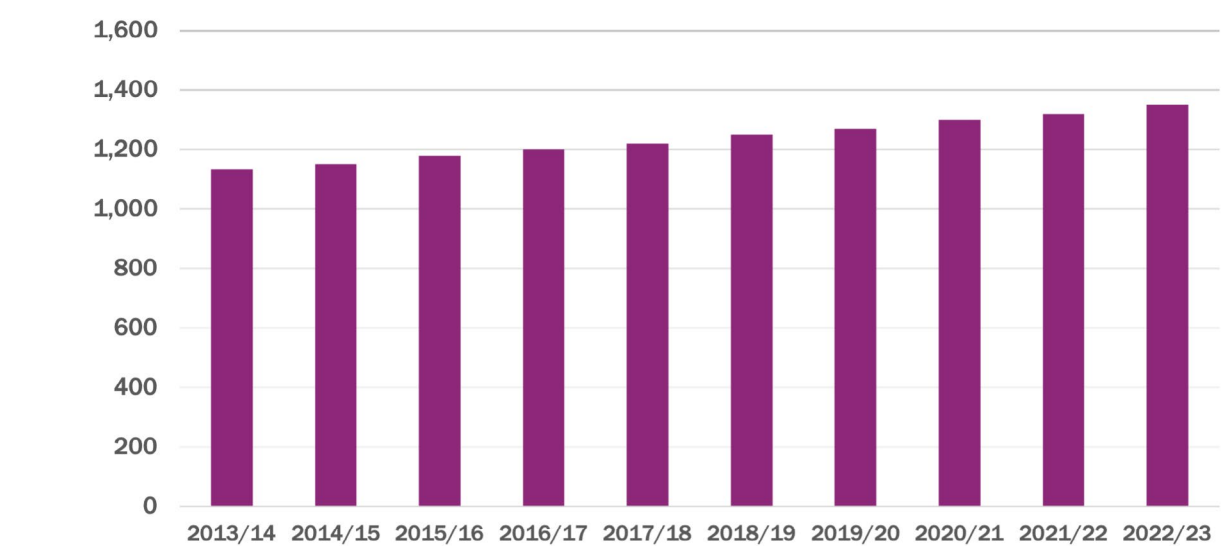


Figure 2: Number of physics graduates in Scotland 2013–23

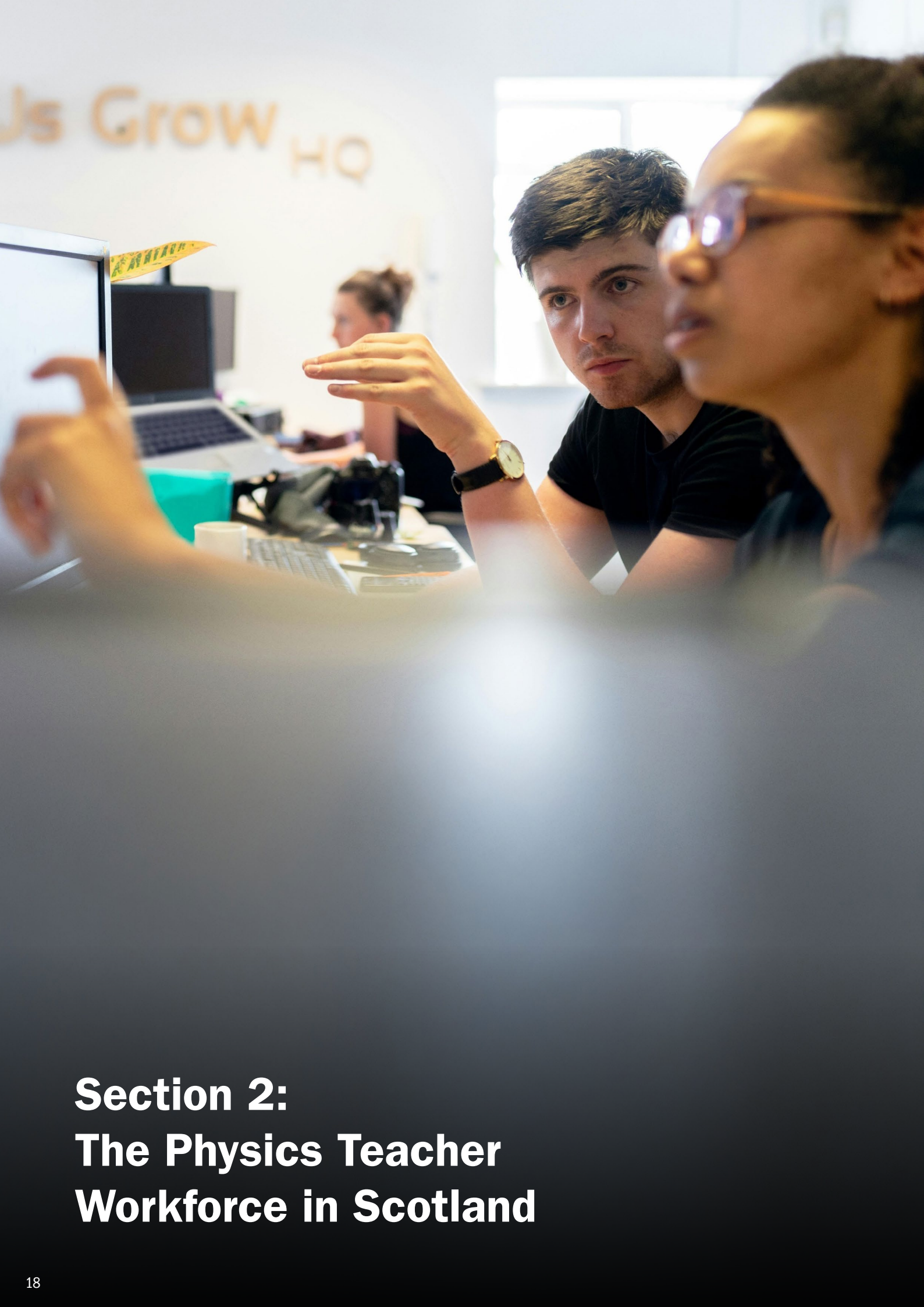
Source: HESA. Table 51 By subject and HE provider. Available: <https://www.hesa.ac.uk/data-and-analysis/students/outcomes/breakdown>

Meanwhile, any decrease in secondary school Higher and Advanced Higher physics enrolment will restrict the domestic pipeline for university physics and engineering courses. This makes institutions highly reliant on international students, threatening course viability. This vulnerability is acute for physics, which is more expensive to teach than classroom-based subjects due to the need for expensive laboratory equipment and limits on the number of students who can use them simultaneously.¹⁸

Universities are vital to Scotland’s economy and innovation. While Scottish physics departments rate above the UK average for quality,¹⁹ information gathered by the IOP shows that a quarter of department heads fear closure within two years, and more anticipate staff cuts or course withdrawals. Following post-Brexit increases, international student intake dropped sharply in 2023–24 amid tighter immigration controls.²⁰ This triggered funding crises and emergency government intervention, prompting a long-term review of their future funding framework.²¹ Ultimately, maintaining Scotland’s global academic reputation in physics depends on a stable supply of domestic physics pupils, which is threatened by reduced capacity to teach physics at school level.

¹⁷ See HESA data <https://www.hesa.ac.uk/data-and-analysis/students/what-study>
¹⁸ See Physics Matters: Funding the Foundations of Growth, IOP (2025), at www.iop.org/about/publications/physics-matters-funding-the-foundations-of-growth.
¹⁹ In the 2021 REF exercise (see <https://2021.ref.ac.uk/>), the vast majority of the research submitted by Scottish institutions in Unit of Assessment 9 (Physics) was rated in the top two categories, as either world-leading (grade 4) or internationally excellent (grade 3): Scottish institutions exceeded the overall GPA average of 3.43, and were cited by Universities Scotland as “a major contributor to international physics and astronomical research”.
²⁰ See www.universities-scotland.ac.uk/hesastudent25/.
²¹ See www.universities-scotland.ac.uk/future-framework/.





Section 2: The Physics Teacher Workforce in Scotland

2.1 Trends in teacher numbers and registrations

Teacher census data indicates that the number of registered physics teachers in Scotland fell below 780 in 2025, compared with more than 900 less than 20 years ago. This 14.7% decline is more pronounced than in other STEM subjects, except for computing science.

Although teacher numbers overall have declined over the same period, the past few years have seen a notable divergence in the proportion of physics teachers relative to secondary teachers of all subjects.

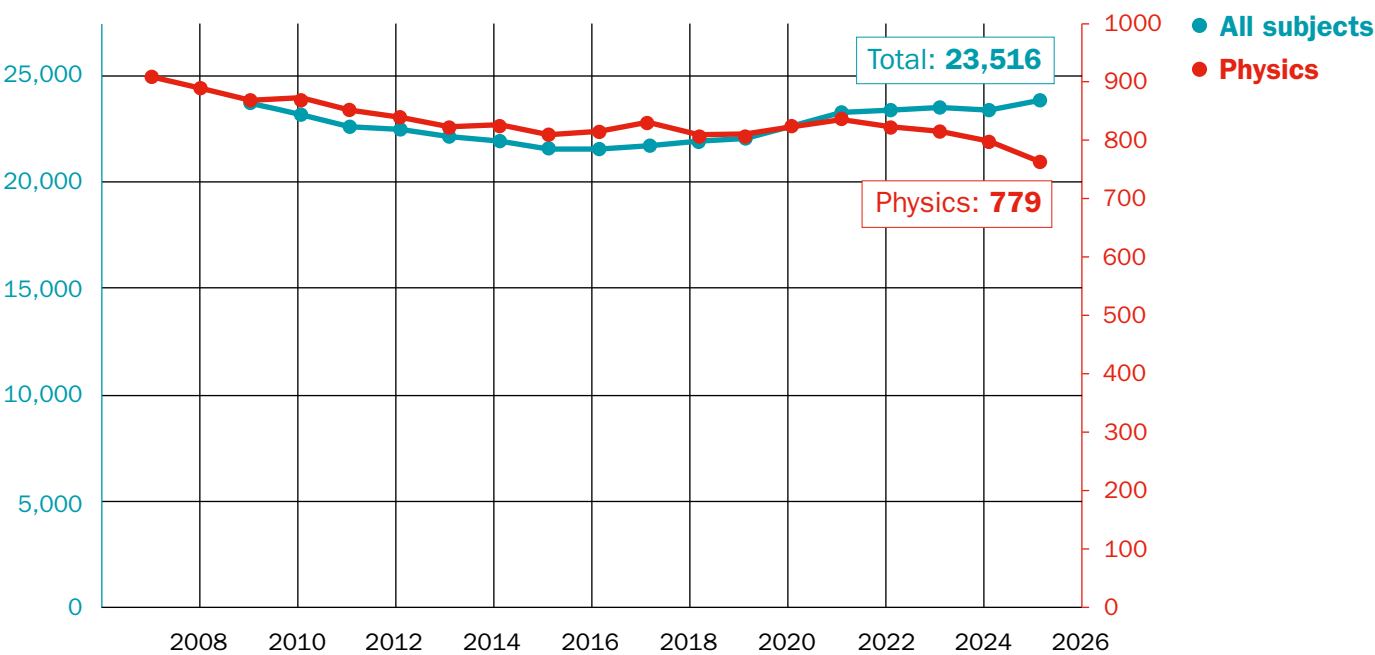


Figure 3: Teacher census; registered physics teachers vs registered teachers

Source: Teacher census, supplemental data, 2010–25

NB blue X axis (left) corresponds to blue line; orange X axis (right) corresponds to orange line

Around 30% of physics teachers in Scotland are either in an immediate retirement window or are due to retire in the next 5–10 years



Registrations

The General Teaching Council Scotland keeps separate records of registered teachers (as opposed to FTE positions filled). During the past five years, registered physics teachers have declined in number by 3.9%, a greater drop than seen in English, mathematics, or chemistry. The number of registered biology teachers actually *increased* in this period

	2021	2022	2023	2024	2025	Difference 2021–25	
						Number	Percentage
Biology	2,924	3,013	3,007	2,997	2,948	+24	0.8%
Mathe-matics	4,464	4,689	4,611	4,486	4,373	-91	-2.0%
English	5,043	5,106	5,020	4,971	4,882	-161	-3.2%
Chemist	2,287	2,353	2,305	2,266	2,210	-77	-3.4%
Physics	1,737	1,768	1,725	1,690	1,669	-68	-3.9%

Figure 4: General Teaching Council registrations 2021–25 in biology, mathematics, English, chemistry and physics

Source: GTC Scotland

Age and retirement

The median age of registered physics teachers in Scotland is 47.²² This is higher than for all other subjects except for economics, computing science, and German. A substantial proportion of physics teachers are aged 50 or older, and around 30% of physics teachers in Scotland are either in an immediate retirement window or are due to retire in the next 5–10 years.

Leaving rates other than retirement also affect these figures. Modelling by the Scottish Government analytics team for the Teacher Workforce Planning Advisory Group suggests the attrition rate for specialist physics teachers exceeds the secondary school average of 9.8%, which aligns with anecdotal evidence. If accurate, this means that for every ten teachers starting their probation year, at least three leave public school classrooms within five years. This total includes those who transition to roles outside of teaching, move into the independent sector, or teach outwith Scotland. The modelling does take account of the fact that, along with computing science teachers, physics teachers have the most readily available alternative opportunities in the labour market outside of teaching, which reflects the versatility and value of their knowledge and skills.²³

2.2 Rurality, departmental resilience, and local factors

Small departments, particularly in rural and remote schools, face disproportionate challenges. The departure of a single physics teacher can effectively eliminate local provision at Higher or Advanced Higher levels, with long-lasting effects on pupil progression.

²² See 2024–25 Registration report and data insight, General Teaching Council for Scotland, at www.gtcs.org.uk/documents/pages/registration-report-2024-25-data-and-insight-06-information-about-registrations
²³ “The characteristics of and earnings and outcomes for physics teachers”, Allen, Sibieta and Vignoles (2018) (Institute of Fiscal Studies), at <https://ifs.org.uk/publications/characteristics-and-earnings-and-outcomes-physics-teachers>

Freedom of information requests were submitted to education departments in all 32 local authorities. Among the 251 schools in the 26 authorities which responded:

- There are 6 schools with no physics teachers.
- A further 18 schools have less than 1 FTE physics teacher. This compares unfavourably with those who have less than 1 FTE position in either chemistry (13 schools) or biology (7 schools).
- Physics teachers are routinely the least well-represented science specialists within school staff teams. There was an average of 3.5 biology teachers per school, 3.7 chemistry teachers, and 2.1 physics teachers; 225 schools had more biology teachers than physics teachers, and 184 had more chemistry teachers than physics teachers.
- The top 50 performing schools overall in Scotland which responded had an average of 3.1 physics teachers.²⁴ The 50 worst performing schools which responded had an average of 1.2 physics teachers.²⁵

Physics teachers are routinely the least well-represented science specialists within school staff teams



Vacancies

Recruitment to posts is often difficult, leading to vacancies being readvertised, repeated reliance on temporary arrangements and newly qualified teachers. Over time, this reduces departmental resilience and increases workload for remaining staff.

In May 2025, School Leaders Scotland (SLS) published the results of a survey of 147 Scottish secondary schools,²⁶ which noted that:

- Over 50% of secondary teacher vacancies are in STEM subjects;
- Over half of vacancies occur in schools outside the Central Belt, with only 20% of the Scottish population living outside the Central Belt; and
- Subjects like physics have been removed from or reduced in the curriculum. In 3 of the 147 schools responding, physics provision had been reduced by more than 50%.
- An analysis of vacancies posted on the MyJobScotland website also seems to confirm the SLS data that repeated vacancies of physics teachers occur most frequently in non-Central Belt authorities. Improved data on the actual vacancies, both advertised and ‘hidden’, across Scottish schools is required.

²⁵ by percentage of S5 pupils obtaining 5 or more Highers at A–C grade, per <https://datamap-scotland.co.uk/2024/05/scottish-secondary-school-league-tables/>
²⁶ See www.sls-scotland.org.uk/wp-content/uploads/2025/06/SLS-Survey-on-Shortage-Subjects-Report-May-2025.pdf
²⁷ “Exploring the reasons why former physics teachers in Scotland left teaching”, Farmer and Whalley (2025), School Science Review Issue 393 p 56, at www.ase.org.uk/resources/school-science-review/issue-393/exploring-reasons-why-former-physics-teachers-in-scotland

Career structures in subject teaching

The previous departmental structure, featuring a Principal Teacher for Physics in every school rather than a multi-discipline Science Faculty Head, acted as a systemic leveller. Experienced teachers seeking career development were drawn to these promoted posts even in rural or remote areas, effectively distributing expertise across Scottish secondary schools.²⁷ This created informal benefits, such as teachers relocating from the Central Belt to rural schools for positive career progression, and even later recommending the experience to younger colleagues.

This model changed following the 2001 McCrone agreement,²⁸ which allowed flexible school career structures. Local authorities widely adopted the shift away from subject-specific promoted posts as a cost-saving measure. While never fully evaluated, research indicates this faculty model yielded poor results, eroding subject expertise and degrading team communication.

“Simply put the faculty model has had a negative impact on every area when compared to subject led department model in terms of education and wellbeing for young people and teachers.”²⁹

It also faced professional resistance, including strike ballots in Dundee and West Dunbartonshire, with teaching unions condemning its effect on leadership depth.³⁰

Recognising these issues, some measures have been introduced to create a new lead teacher role,³¹ potentially analogous to former principal teacher grades,³² but take-up of these has been extremely low, with the latest Scottish teacher census showing just two local authorities creating only 10 FTE lead teacher roles between them.

2.3 Socioeconomic factors

The annual teacher census allows us to analyse which Scottish local authorities have the lowest number of physics teachers, per school or per 100 pupils, mapping these against rurality and socioeconomic status via the Scottish Index of Multiple Deprivation (SIMD).³³

Between 2019 and 2024, the ten local authorities with the greatest increases in physics teachers were in areas of relatively low social deprivation while the ten authorities with the sharpest declines are in areas of high social deprivation.

A similar pattern emerges regarding physics teachers per 100 S4 pupils, with those local authorities with the lowest teacher-to-pupil ratios being found in areas of high social deprivation.

2.4 Consequences for pupils and teachers

The combined effects of these trends of declining teacher numbers, out-of-specialism teaching, and limited departmental capacity, suggest reduced pupil uptake, fewer courses available (notably at Advanced Higher), lower attainment, and narrower post-school options in physics. These effects create a reinforcing negative feedback loop which is difficult to address without sustained intervention.

During a focus group, IOP Scotland has been told by teachers experiencing these trends in schools that declining provision where they are the sole physics specialist is a highly isolating experience, where colleague contact occurs almost entirely virtually.

One teacher said:

“At least on a yearly basis, there’s at least one post in [the Scottish physics teachers email discussion group] from someone saying, ‘Hi, I’m the only physics specialist in my school. I am a probationer. The department has not quite been ransacked but has been degrading over time. There are no resources. I don’t have any question packs. I don’t know what experiments to do. Can you help me?’”

Faculty heads from other sciences offer moral and generic support but cannot engage with physics teaching at advanced levels. Although some local authorities run subject networks, they are not universal and may only meet virtually once or twice a year. Though these are valued by isolated or less experienced teachers, this support is limited, as schools often cannot afford the supply cover or travel expenses required for in-person attendance.

2.5 Consequences and challenges for schools

Organising school staffing is a complex balancing act. Leaders must reconcile the broad requirements of Curriculum for Excellence with strict class size regulations for practical subjects, all while ensuring specialist teachers are available for senior phase courses. Furthermore, staffing models must adapt to fluctuating school rolls, inclusion of pupils with additional support needs and the logistical constraints of timetabling and non-contact time.

IOP Scotland also asked each local authority about the effects of teacher shortages on their ability to offer a full curriculum to their pupils. Most did not give substantive answers or said they did not hold the information. However, some individual school responses were insightful:

“All secondaries have sought to find workable solutions; however, it is very challenging and may not be able to in future years if teacher shortages continue or worsen.”

“All settings have experienced difficulties in getting supply teachers over all subject area however less so for social subjects and PE.”

“Due to pupil numbers and staffing only 2 senior phase classes in physics can be timetabled with at least one of these being bi-level.”

²⁸ A Teaching Profession for the 21st Century, Scottish Government (2001), at <https://dera.ioe.ac.uk/id/eprint/10785/1/0042924.pdf>

²⁹ “Sharing research into the impacts of faculty management structures in Scottish Secondary schools”, Nixon and Barlow (2023), *Scottish Government Education Research Seminar Series*, at <https://abdn.elsevierpure.com/en/activities/scottish-government-educational-research-seminar-series/>

³⁰ e.g. “In many schools this has been a difficult and controversial process and, for many individual Principal Teachers, a process little short of disastrous” in *The EIS and Leadership in Schools* (2010), p. 10, at www.eis.org.uk/Content/Images/education/eis%20leadership%20policy%20document%20-%202nd%20edition%20march%2010.pdf; see also “SSTA Rejects Dundee Management Structures in Secondary Schools” (2019) at <https://ssta.org.uk/ssta-rejects-dundee-management-structures-in-secondary-schools/>

³¹ <https://www.gov.scot/publications/independent-panel-career-pathways-teachers-final-report/>

³² Part 2 Appendix 2.22 of SNCT Handbook: <https://www.snct.org.uk/library/2873/Part%202%20Appendix%202.22%20Lead%20Teacher%20Framework.pdf>

³³ <https://simd.scot/>

2.6 What happens when schools face a shortfall

When secondary schools cannot fill physics teacher vacancies, they deploy one or more of six coping strategies:

(a) Multi-course teaching

This involves teaching different course levels (e.g., National 5, Higher, Advanced Higher) simultaneously in one classroom. Data from the 2025 Science Teaching Survey³⁴ and SSTA³⁵ indicates this is now the norm, affecting 66% of senior phase physics classes at two different levels, and 10% across all three.

- **Impact on teachers:** Teachers must manage different curriculum levels, lesson plans, homework, and assessment schedules simultaneously. This elevated workload directly accelerates teacher attrition.
- **Impact on pupils:** Instruction is fragmented, forcing a slower pace and reducing guided learning. Pupils only receive a fraction of the teacher’s attention, shifting the burden to independent learning via worksheets, textbooks, or videos. While high achievers may cope, less able pupils risk becoming disengaged, widening the attainment gap.
- **Safety concerns:** Since managing practical equipment simultaneously with other teaching introduces serious logistical and safety risks, split attention often requires a shift in focus from practical work to theory.

Multi-course teaching is most prevalent in smaller, rural, or deprived schools where low pupil numbers make separate classes inefficient. This can create a crisis-point effect in schools with a lone physics teacher, where their workload can already be intense and there are few readily available forms of support or relief. This structural vulnerability also means that if that single specialist leaves, the entire department can collapse, causing a total loss of the subject for that school community.

(b) Out-of-specialism teaching

Schools frequently ask biology or chemistry teachers to teach physics, particularly at the Broad General Education (BGE/S1–S3) level. While qualified in general science, non-specialists often lack specific subject pedagogical depth.³⁶ This keeps classrooms open but can damage pupils’ attitudes toward physics. If non-specialists are less able to easily answer curiosity-driven, “off-curriculum” questions, they may inadvertently discourage pupils from pursuing physics pathways.

(c) Curricular narrowing

If senior-level specialists cannot be found, schools may stop offering Advanced Higher or Higher Physics. School Leaders Scotland reports that 2% of schools have removed physics from their curriculum due to long-term vacancies. Affected pupils are either denied progression or forced to travel to neighbouring schools. While this saves immediate salary budgets, this can block pupil access to physics and engineering university degrees. The consequence of such actions is that fewer physics graduates enter the system, worsening the teacher shortage cycle.

(d) Consortium arrangements

Local authorities sometimes pool pupils from multiple schools into a single combined class, utilising physical travel or digital links. While this retains the course, travel times eat into the school day, and virtual setups offer a poorer experience while weakening a pupil’s sense of school belonging. Furthermore, these arrangements are rarely viable in rural areas, exacerbating geographic disadvantage.

(e) Virtual learning

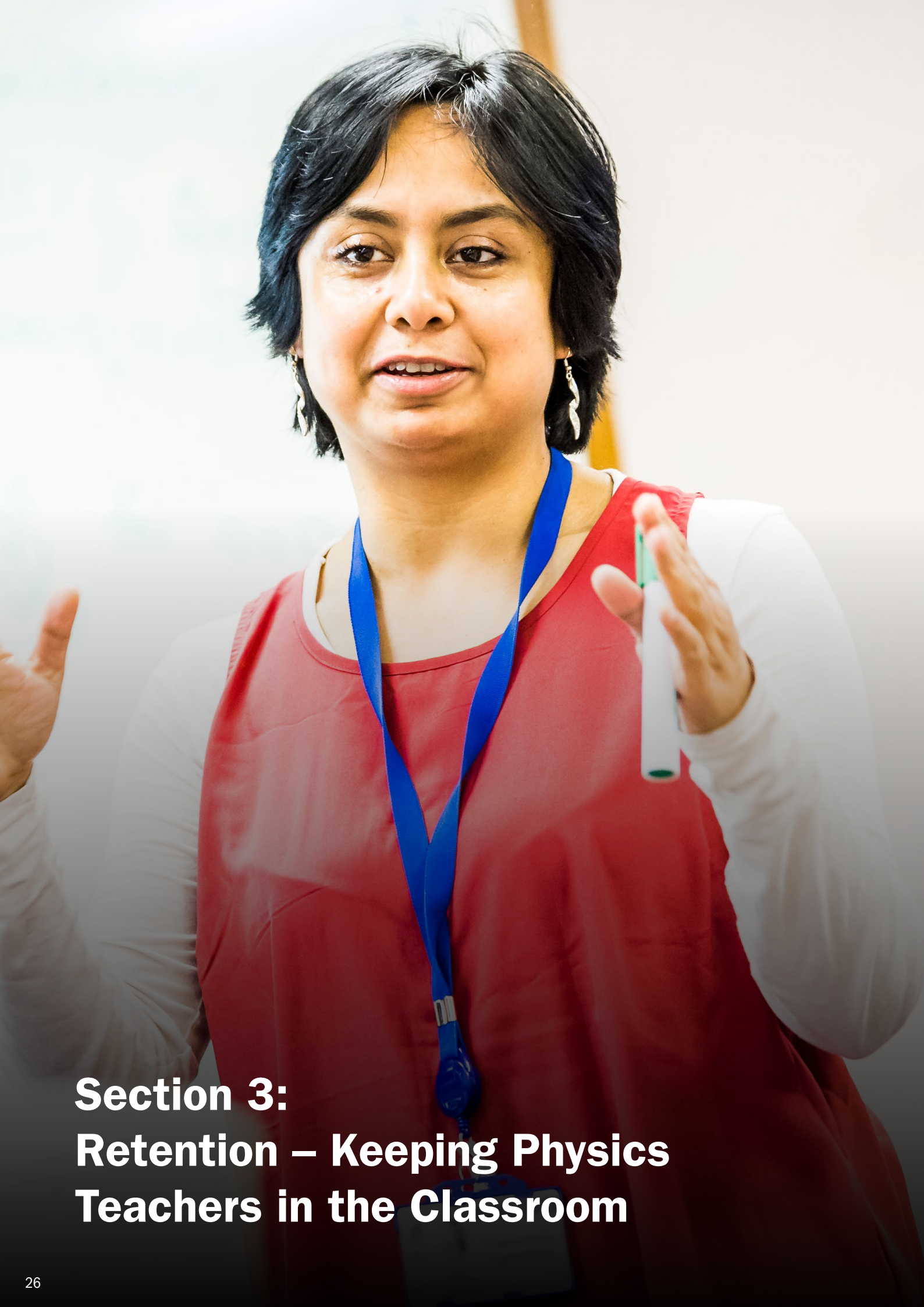
Scotland utilises the e-Sgoil and Scholar³⁷ platforms for interactive digital learning, although the financial sustainability of the Scholar platform is in doubt.³⁸ Even if extended, allowing a specialist teacher to teach pupils via webcam, for example, remote learning is a limited fix and omits supervised, hands-on practical work. Lessons from COVID-19 lockdowns show that virtual learning can lead to passive attention, lower motivation, and reduced peer collaboration. It also makes it harder for teachers to assess understanding in real time and risks disengaging pupils with additional support needs.³⁹

(f) Reliance on probationers and temporary staff

Schools frequently rely on the one-year Teacher Induction Scheme to plug gaps. Although this provides an in-person presence in the classroom, the lack of a permanent specialist stalls long-term curriculum development. This is particularly damaging under the Curriculum for Excellence framework, which tasks teachers with designing localised curricula. Additionally, NASUWT data⁴⁰ shows an increasing reliance on temporary supply staff, with up to 20% of the entire teaching workforce on short-term contracts as of 2025.

³⁴ www.rsc.org/policy-and-campaigning/education/the-science-teaching-survey
³⁵ https://ssta.org.uk/subjects-and-multi-course-teaching/
³⁶ “Subject knowledge for teaching physics: A framework for teachers of physics”, IOP (2024) at https://spark.iop.org/framework

³⁶ “Subject knowledge for teaching physics: A framework for teachers of physics”, IOP (2024) at https://spark.iop.org/framework
³⁷ https://scholar.hw.ac.uk/
³⁸ https://www.tes.com/magazine/news/general/scholar-scottish-online-learning-platform-could-close
³⁹ “Effects of remote learning during COVID-19 lockdown on children’s learning abilities and school performance: A systematic review”, Cortés-Albornoz et al, International Journal of Educational Development (2023/101) 102835 at https://pmc.ncbi.nlm.nih.gov/articles/PMC10266495/; and “The Delivery of Education and Certification, Impact on Children and Young People: evidence to the Scottish COVID-19 Inquiry”, Prof G McCluskey et al (2023) (Moray House School of Education and Sport, University of Edinburgh), at www.covid19inquiry.scot/sites/default/files/2024-04/Portfolio-4-University-of-Edinburgh-Education-and-Certification-Impact-on-Children-and-Young-People-Updated-Overview.pdf
⁴⁰ See https://www.sundaypost.com/fp/short-term-teachers/#:~:text=%E2%80%9CFor%20pupils%2C%20the%20significant%20number,the%20country%20to%202023%20levels.



Section 3: Retention – Keeping Physics Teachers in the Classroom

3.1 Retention as the primary lever

Improving retention is the most immediate and cost-effective way to stabilise the physics teacher workforce. When an experienced physics teacher leaves, the impact extends beyond losing a single post, with schools also losing subject expertise, mentoring capacity, and departmental leadership. Improving retention reduces recruitment demand, increases system resilience, and delivers better outcomes for pupils.

Evidence from England shows that physics teachers have higher attrition rates than most other secondary subjects, particularly within their first five years. Although Scotland does not publish equivalent subject-specific attrition data, the Teacher Workforce Planning Advisory Group's modelling seems to indicate the same trend also applies in Scotland, and even indicates that Scotland's rates are now worse than in England.⁴¹

3.2 Causes of attrition

To understand how to retain teachers, it is important to understand why they leave. The most significant study of this was conducted by Farmer and Whalley⁴² which identified that there is rarely a single reason. Although physics teachers are often motivated to continue because of enthusiasm for the subject, tipping point factors include:

- lack of clear career progression routes
- excessive workload
- issues with school leadership and accountability
- poor pupil behaviour and inadequate means of addressing it
- lack of flexible working

There were two distinct patterns among leavers. Earlier and mid-career leavers had become disillusioned by lack of career progression and workload and often found more lucrative opportunities outside of teaching. Those later in their careers had become “scunnered” with the modern school environment and either took early retirement or transitioned into more flexible or part-time adjacent roles.

Although higher salaries in private sector roles or a desire to teach in independent schools was not typically a primary motivator, it may have become a factor because these options became available when other frustrations peaked.

We examine these factors in turn.

3.3 Career pathways and progression

This emerged as the most significant factor in the research.

For many physics teachers, career progression is perceived to require moving into school management. This belief is not accidental, it is actively reinforced by structural elements of the Scottish school system, including the flat career structure following the McCrone Agreement, the replacement of Principal Teachers with Faculty Heads, and the removal of the Chartered Teacher scheme. These leave few pathways for systemic recognition or financial benefit while staying in the laboratory or classroom.

⁴¹ <https://www.iop.org/sites/default/files/2025-09/The-physics-teacher-shortage-and-addressing-it-through-the-3Rs-Retention-Recruitment-and-Retraining-England.pdf>

⁴² “Exploring the reasons why former physics teachers in Scotland left teaching”, Farmer and Whalley (2025), School Science Review Issue 393 p 56, at www.ase.org.uk/resources/school-science-review/issue-393/exploring-reasons-why-former-physics-teachers-in-scotland.

Some participants in the study reported feeling they had become ‘stuck’ in their post at the top of the teachers’ salary scale and had no desire to progress into school leadership:

“I could not imagine going any further than Principal Teacher in the role. Just there was nothing there for me that actually appealed to me. So, I felt like sort of a very limited career route. I had kind of reached the top salary scale. So, that was me just sitting there.”

“I looked up the food chain, and I saw a lot of quite unhappy, very stressed people ... And the amount of salary compensation you get for doing that was, in my mind, not commensurate with the amount of effort that it would have required. And then that seemed to continue further up the chain.”⁴³

This situation creates a tension between career development and retaining expert teachers in classrooms. Roles such as Lead Teacher have the potential to address this but have seen limited uptake.

3.4 Workload and working conditions

Physics teachers face some distinctive workload pressures. The mix of practical lab-based experimental work and theory is different for the sciences than other subjects, and often made more complex in the absence of technician support. The physics curriculum consists of a wide range of different topics that require a range of different knowledge and practical skills.

Adding multi-course teaching to this situation amplifies the demands on teachers, as does the management of senior phase classes conducting different experiments for assignments simultaneously. These pressures are exacerbated further in small departments, where teachers may be the sole physics specialist and are required to teach across several year groups simultaneously.

During a focus group we heard from one teacher who said:

“I know there’s a situation where [a school has gone] from, at least in one example, 2.6 FTE down to 1 FTE next year. And all that will happen is that member of staff who’s left will have a significantly increased workload and may or may not choose to remain in the post.”

Although the Scottish Negotiating Committee for Teachers agreed in March 2026 to reduce class contact time by 90 minutes per week,⁴⁴ this is only due to be implemented in secondary schools in 2029. Even still, for physics departments with limited staffing, implementation without additional capacity risks increasing pressure rather than alleviating it. Schools may respond by increasing teaching outside specialism or reducing subject provision, particularly at Advanced Higher.

One other aspect of working conditions for physics teachers is access to sufficient, reliable equipment to conduct demonstrations and experiments appropriately. This can impact on physics teacher morale and job satisfaction. The IOP’s benchmarking tools on science equipment⁴⁵ and subsequent research by the Learned Societies Group on Scottish STEM Education⁴⁶ revealed that physics requires proportionately more equipment than other subjects because more of it is either single-use or limited use. This creates more vulnerability, increasing the possibility of equipment failing or being broken, but also each item is proportionately less central to the curriculum, meaning it has less priority in being replaced. Financial pressure on schools means that equipment replacement budgets are limited and insufficient to cope even with routine replenishment. This means that equipment stocks degrade over time and result in more of the curriculum being taught using simulations and videos rather than practical demonstrations and hands-on pupil practical work, which has been shown to be of far less value for pupils.⁴⁷

One other related factor affecting workload is the sharp decline in science technicians in Scotland’s schools. Between 2010 and 2020, the number of technicians dropped by nearly 30%.⁴⁸ School technicians play a vital role in secondary schools by making practical laboratory work safe and effective, and in turn practical work is a crucial element of high-quality physics education, yet it cannot be delivered without the necessary resources and facilities in place.

3.5 Issues with school leadership, accountability, and pupil behaviour

A recurring theme in the research was a profound frustration with school leadership, which participants describe as overly bureaucratic and dictated by accountability pressures that erode teacher autonomy and professional well-being.⁴⁹ These match wider criticisms voiced by Scottish teaching unions like the SSTA and EIS, who have long condemned senior management cultures for failing to provide adequate, structural support to front-line staff.

Inspection and accountability processes, nationally and within local authorities and schools, can contribute to workload and stress. Physics departments might be particularly affected because inspectors look for “high-quality learning experiences”,⁵⁰ which, in sciences like physics, includes how effectively practical work is used as well as teaching theoretical content. Physics teaching can be more intensive than for some other classes because it takes place in a lab where there is potentially dangerous equipment, adherence to SSERC safety guidelines is essential, and there may be a lack of technician support.

A perceived lack of leadership support becomes particularly critical when dealing with pupil misbehaviour. The combination of this together with factors such as administrative strain and professional isolation creates a potential tipping point that drives valuable physics educators out of the profession.^{51 52}

3.6 Flexible working

Physics graduates have access to alternative careers that often offer greater flexibility. Teaching must compete in this labour market. In one research study, all seven of the less experienced participants in the study who had left teaching identified the lack of flexible working in teaching as a key factor influencing their leaving.⁵³

Flexible working options, including part-time roles, job sharing and phased retirement, can support retention. However, access is inconsistent and often dependent on local school leadership.

⁴³ “Exploring the reasons why former physics teachers in Scotland left teaching”, Farmer and Whalley (2025), School Science Review Issue 393 p 56, at www.ase.org.uk/resources/school-science-review/issue-393/exploring-reasons-why-former-physics-teachers-in-scotland.

⁴⁴ <https://www.gov.scot/news/landmark-deal-for-teachers/>

⁴⁵ See www.iop.org/education/support-school-college-physics-teachers/benchmark-tools.

⁴⁶ “The resourcing of science in Scottish schools”, Farmer, Hardie and Brown (2015), at https://www.researchgate.net/publication/375910790_The_resourcing_of_science_in_Scottish_schools

⁴⁷ “Science practical work in a COVID-19 world; are teacher demonstrations, videos and textbooks effective replacements for hands-on practical activities?”, Moore et al. (2020), at www.ase.org.uk/system/files/SSR_September_2020_007-012_Moore.pdf

⁴⁸ See “Fears over Scotland’s scientific future as STEM technicians fall”, H Rodger, The Herald (29 December 2019), at <https://www.heraldsotland.com/news/18126882.fears-scotlands-scientific-future-stem-technicians-fall/>

⁴⁹ “Exploring the reasons why former physics teachers in Scotland left teaching”, Farmer and Whalley (2025), School Science Review Issue 393 p 56, at www.ase.org.uk/resources/school-science-review/issue-393/exploring-reasons-why-former-physics-teachers-in-scotland.

⁵⁰ How Good Is Our School (4th edn, 2015), (Education Scotland), indicator 2.3: Learning, teaching and assessment, at https://educationinspectorate.gov.scot/media/v5sh3dqt/frwk2_hgios4.pdf.

⁵² “Why did they leave? Exploring the reasons why former physics teachers left teaching”, Whalley (2024) at <https://www.ase.org.uk/resources/school-science-review/issue-392/why-did-they-leave-exploring-reasons-why-former-physics>

⁵³ “Exploring the reasons why former physics teachers in Scotland left teaching”, Farmer and Whalley (2025), School Science Review Issue 393 p 56, at www.ase.org.uk/resources/school-science-review/issue-393/exploring-reasons-why-former-physics-teachers-in-scotland.

3.7 Teaching outside specialism

In Scotland, teachers are registered with the General Teaching Council Scotland (GTCS) in specific subjects (which is not the case elsewhere in the UK). To achieve registration as a subject teacher, they must hold both a degree which has 80 SCQF points in that subject and a teaching qualification such as the Postgraduate Diploma in Education (PGDE). However, there are circumstances where someone might teach outside their specialism in a Scottish school. These include:

- Most commonly, physics is taught as part of integrated science to S1-3 pupils by teachers within a sciences faculty, meaning that biology and chemistry teachers cover physics content (and vice versa).
- Temporary/short-term cover in the senior phase, where if a headteacher is satisfied that a teacher has sufficient ability, they may be asked to supervise classes and even introduce material outside their specialism, but they cannot be a “teacher of record” for Qualifications Scotland purposes at National 5, Higher or Advanced Higher level outside their full registration; and
- Provisional (conditional) registration for a teacher who wants to add another subject to their existing registration. They must have at least 40 SCQF credits already in it but can then have up to three years teaching that subject before obtaining the remaining 40 credits (usually through distance learning provider, such as the Open University) to obtain full registration.

There are reasons to believe that staffing pressures are a push factor towards more out-of-specialism teaching. A survey by the SSTA of its members in 2025⁵⁴ suggested that 46% reported teachers being required to teach subjects outside their specialism. And last year NASUWT members in Scotland⁵⁵ also reported increasing levels of teaching outside their specialism and that this was causing disadvantage to pupils.

Teaching outside specialism increases preparation time and workload, reduces teacher confidence, limits depth of subject teaching, and contributes directly to attrition. It also obscures the true scale of the physics teacher shortage, as headline staffing figures do not reflect the extent to which physics is delivered by non-specialists.

Scotland does not systematically collect data on the extent of teaching outside registered subject specialism. This data gap limits effective workforce planning.

3.8 Career-long professional learning (CLPL)

High-quality CLPL which is subject-specific supports both teaching quality and retention but access to it is often constrained by time and funding. The IOP’s report *Subjects Matter*⁵⁶ found that adequate subject-specific professional learning is not just an optional add-on, but a primary driver for both teacher effectiveness and long-term retention by tackling professional isolation, improving agency and identity as physics teachers, increasing confidence and morale, and guarding against burnout. We therefore recommend that at least 50% of teachers’ professional learning time, both personal and collegiate, should be high-quality subject-specific professional learning. This should focus not only on substantive knowledge but also disciplinary knowledge (how physicists think) and pedagogical content knowledge (how to apply and explain that knowledge to pupils in classroom settings).⁵⁷ Where this has been done it has been shown to have a positive impact on the quantity and quality of teacher professional learning undertaken by teachers, and on the culture in the schools.⁵⁸

3.9 Recommendations on retention

Several of the factors affecting teacher attrition identified here are deep-seated and will take time to address. Accordingly, the Scottish Government and local authorities should work together to develop, adopt, and implement a ten-year strategy to resolve the physics teaching workforce decline, in which retention should be the most significant focus.

The ten-year strategy should consider each of the following elements:

1. Review the faculty model in Scottish schools and its impact, with an ambition to ensure dedicated subject-specific leadership and mentoring capacity and formal recognition for classroom-focused promotion paths
2. Formal, consistent national guidelines for schools to offer flexible working options such as jobsharing, part-time roles, and phased retirement
3. Ring-fence local authority budgets dedicated to the routine replenishment and replacement of classroom physics and science equipment
4. Mandate minimum science technician support hours per physics department to alleviate logistical and administrative burdens on teaching staff
5. Address and reduce demands on teachers to carry out avoidable administrative and bureaucratic tasks such as data entry
6. Support and resource the implementation of systemic, clear, and consistent positive behaviour strategies ensuring teachers are supported and not isolated when facing pupil disruption
7. Collect national data for Scottish education to drive informed improvement and workforce planning, including monitoring and publishing the exact extent of out-of-specialism teaching across all secondary schools, routine leaver interviews for those exiting the profession, and surveys of all teachers in each of their first five years to capture and act upon pressures which drive attrition
8. Cut multi-course teaching by half by 2031
9. Develop high-quality subject specific professional learning to ensure that an entitlement to 50% of their professional learning (during personal professional development and collegiate time) being subject-specific, can be delivered
10. Enhance subject-specific career-long professional learning for non-specialist teachers who teach physics during the Broad General Education phase
11. Review how salary, conditions of service, and career pathways for teachers in shortage subjects can be improved to ensure teaching is an appealing career option

⁵⁴ <https://ssta.org.uk/secondary-teacher-shortage-a-deepening-crisis/>

⁵⁵ www.nasuwt.org.uk/article-listing/use-non-specialist-teachers-disadvantaging-pupils.html

⁵⁶ www.iop.org/about/publications/subjects-matter

⁵⁷ See “The Fundamentals of 11-19 Physics”, IOP (2024) at <https://www.iop.org/about/publications/fundamentals-11-19-physics> and “Subject knowledge for teaching physics: A framework for teachers of physics”, IOP (2024) at <https://spark.iop.org/framework>

⁵⁸ See “Meeting the challenge of providing high quality continuing professional development for teachers”, Leonardi et al. (2022) at <https://cms.wellcome.org/sites/default/files/2022-02/final-cpd-challenge-evaluation-report.pdf>



Section 4:
Recruitment – Increasing Entry
to Physics Teaching

4.1 Persistent recruitment shortfalls

Recruitment into physics initial teacher education (ITE) has been persistently low for a decade. In many years, intake has fallen well short of targets, often by more than half. Small cohort sizes mean that even modest absolute shortfalls have significant impacts on future supply.

Year	Physics			All subjects (secondary)			Diff physics vs all
	Target	Intake	%age	Target	Intake	%age	
2025	131	28	21.4%	2,000	1,008	50.4%	-29.0%
2024	131	42	32.1%	2,000	1,062	53.1%	-21.0%
2023	131	38	29.0%	2,000	1,002	50.1%	-21.1%
2022	131	60	45.8%	2,000	1,211	60.6%	-14.7%
2021	117	59	50.4%	1,800	1,527	84.8%	-34.4%
2020	120	84	70.0%	1,800	1,647	91.5%	-21.5%
2019	122	76	62.3%	1,800	1,445	80.3%	-18.0%
2018	81	60	74.1%	1,515	1,350	89.1%	-15.0%
2017	77	56	72.7%	1,750	1,226	70.1%	+2.7%
2016	60	61	101.7%	1,350	1,198	88.7%	+12.9%

Figure 5: ITE recruitment rate versus ITE recruitment targets 2016–25

Source: provisional PGDE routes – intakes from Teacher Workforce Planning Group and Scottish Government; targets from Scottish Funding Council

Although the physics ITE intake has been below target level for several years, in the post-COVID-19 era, it has fallen off a cliff, underperforming by more than 60% against targets since 2021. In the past three years, it has underperformed by more than 70% and is the worst-performing subject for percentage intake over this period.

As the table shows, although shortfalls across secondary teacher ITE intakes are common, and have worsened in the post-COVID-19 era, there is a consistent underperformance in physics compared with all secondary subjects. Since 2018, physics has underperformed average secondary recruitment success by more than 20%. Physics has not performed at or above average secondary ITE recruitment levels since 2017.

Across 2023, 2024 and 2025 combined, physics performs the worst of all subjects in secondary ITE recruitment rates, though the only other subjects under 35% in this period are all STEM subjects.

Secondary subject	ITE recruitment rate 2023–25
Physics	27.5%
Maths	30.8%
Chemistry	31.2%
Technological Education	34.6%
Modern Languages	37.9%
Computing	40.4%
Music	45.7%
Geography	47.1%
Biology	50.9%
Home Economics	53.1%
Religious Education	53.9%
English	56.0%
Gaelic	56.7%
Art	64.0%
Business Education	73.3%
Psychology	74.1%
Modern Studies	82.8%
Drama	82.9%
History	103.5%
Physical Education	115.4%

Figure 6: 2023–25 combined subjects ITE recruitment rates

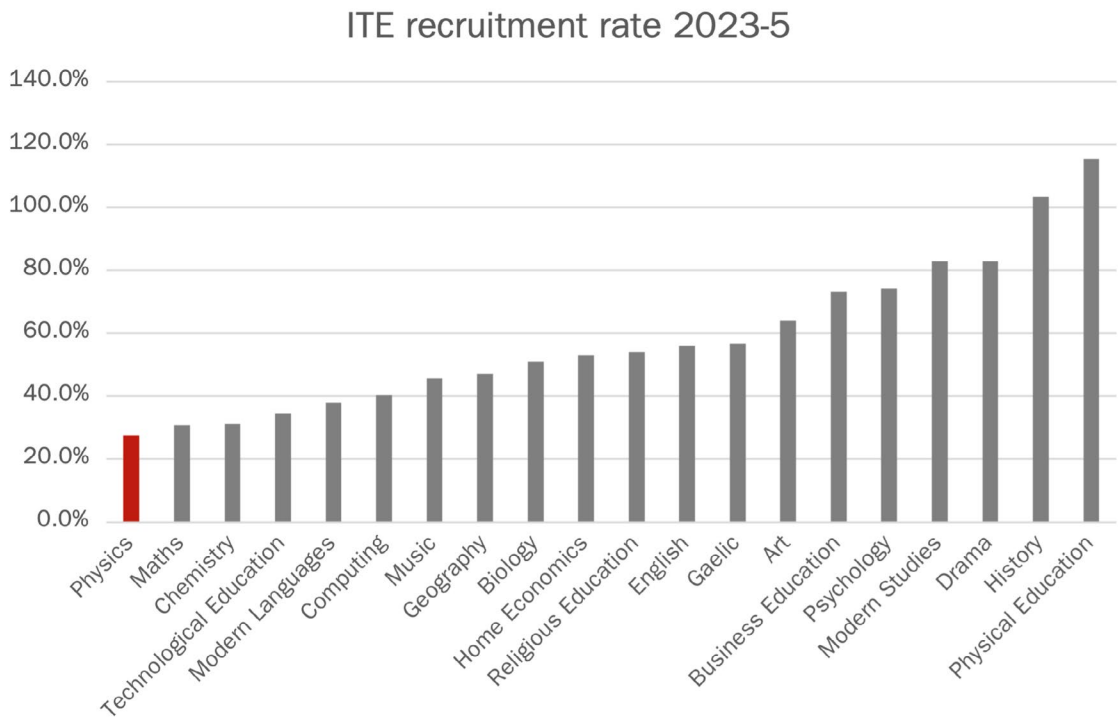


Figure 7: ITE recruitment rate 2023–25

The sharp and steady decline in recruitment rates has turned the physics teacher numbers issue from a headache into a significant threat to the STEM pipeline and university entry. While targets have increased in recent years to reflect workforce need, this seems to have had little or no effect on improved recruitment, indeed, the opposite is true. This suggests that targets may have to be increased further.

Without changes to incentives, support and system design, these high targets are unlikely to be met. Consistent failure to meet recruitment targets creates a slow burn challenge for the physics teaching workforce. If greater demands are placed on the existing workforce, this is likely to increase burnout and fatigue exacerbating the retention problems discussed in section 3.

How are recruitment targets set?

Recruitment targets are set by the Teacher Workforce Planning Advisory Group (TWPAG), who advise the Scottish Government, who in turn issue formal guidance to the Scottish Funding Council (SFC). According to papers produced for the TWPAG, the process is designed to be structured, longitudinal and data-driven, assessing not only current workforce health but their demographic profile, and projected school rolls using National Records of Scotland data. Models consider resignations, returners, maternity, and paternity leave, but also market conditions and other work options for those who undergo ITE.

The routine missing of physics teacher recruitment targets creates a compounding deficit. Despite the significant shortfalls against target in recent years, each following year’s targets have not been higher to compensate. This seems to indicate that these targets are in practice capped by the numbers which universities delivering ITE have the physical capacity to accommodate rather than the modelled demand.

The shortfalls also present a financial risk to universities carrying out teacher training as the Scottish Government can claw back funding for unfilled places (although the core cost of delivery is not reduced). This effect has been seen at the University of Dundee and the University of the West of Scotland which from 2026-2027 will no longer offer physics ITE.

Why are the recruitment targets not being met?

The only notable study of physics undergraduates and their attitudes to teaching⁵⁹ revealed that although 93% of physics undergraduates agree that teaching is an important job for society, 42% had never considered it at all for themselves, and 32% explicitly considered it but actively decided against it. Undergraduates were aware of the market value of a physics degree and that, over time, teaching compared poorly with the alternatives for career-long earning potential.

There is also an aversion to dealing with younger, less motivated, and more disruptive pupils, and to teaching broader non-physics science in S1–3. Some also harboured self-doubt that they would have the skill to inspire pupils with no initial interest in physics.

There is comparatively little content within the physics degree on teaching, tutoring, public engagement, science communication or pedagogy, and pathways and funding support for teaching were comparatively little-known and not actively promoted at careers fairs and similar events.

⁵⁹ Attitudes of Physics Undergraduates on Teaching Physics in High Schools, Sneddon and Jones (2024) presentation at Scottish Educational Research Association, at www.gla.ac.uk/media/Media_1151626_smx.pdf and How might we improve recruitment into postgraduate teacher preparation programmes? Insights from undergraduate physics students' views about becoming a secondary school physics teacher, Jones and Sneddon (2026) at <https://iopscience.iop.org/article/10.1088/1361-6552/ae8112>

Despite extensive statistical modelling by the Teacher Workforce Planning Advisory Group, there remains limited knowledge about why physics is among the worst, or statistically the worst, subject in attracting recruits. Although it is known that physics graduates have more widespread alternative employment options outside teaching which are better paid, more robust data and analysis of why eligible physics graduates do not apply for ITE in Scotland is required to inform policy changes.

4.2 The vicious circle effect

The persistent decline in numbers of physics teachers is linked to the decline in physics pupils taking national qualifications in school. Because of chronic, long-term under-recruitment, many state secondary schools have only one or fewer FTE in-field physics specialist, and this disproportionately affects schools in rural and socioeconomically disadvantaged areas. Fewer pupils progressing to Higher or Advanced Higher levels will impact on the downstream university talent pool from which future teachers are recruited.

4.3 Financial compensation

Baseline salaries

Even without short-term supplements, the baseline salary for newly qualified physics teachers compares well with other roles in the labour market for those with similar qualifications and experience.

Newly qualified physics teachers are guaranteed a one-year probationary post within a local authority school. The 2025/26 baseline probationer salary is £34,938 (scheduled to rise to £36,159 on 1 August 2026). Upon successful completion of the induction year and achieving full GTCS registration, the baseline starting salary immediately climbs to £41,916 for 2025/2026 (rising to £43,383 in August 2026). This main grade scale then tops out at over £52,600 within five years.

These compare well with starting salaries for qualified physicists in industry (which are typically around £30,000 across the UK) but in time rise above the teacher salary ceiling.

Bursaries and incentives

Evidence from England shows that bursaries increase recruitment into shortage subjects.⁶⁰ Physics graduates face intense competition from other sectors, making opportunity cost a significant factor in career choice. Financial incentives alone will not solve recruitment challenges, but they are a necessary component of a credible strategy.

Teaching Bursary in Scotland

Scotland's financial incentives for physics teaching are modest by comparison with those in England. The Teaching Bursary in Scotland (TBiS) is focused explicitly on career changers, not newly qualified graduates, in several priority subjects which includes physics. Those applying for ITE must have been out of full-time education for 3 years, working for 3 of the past 7 years, and have a 2:1 honours degree in the relevant subject. However, the impact of the bursary scheme is limited. Evaluation data from Skills Development Scotland for 2024–25⁶¹ shows that only four students went into ITE in physics as beneficiaries of the scheme, and while this increased to 14 in the 2025–26 cohort, those levels by themselves are not enough to address the recruitment gap.

Reforms to the bursary system

To support Scottish physics education, IOP Scotland convenes university staff responsible for physics initial teacher education (ITE) to share good practice and discuss common concerns. In early 2025, the group communicated concerns regarding the Scottish Government's career-changer bursary. They noted that stringent degree criteria, restrictive timing eligibility, and practical limitations severely restrict the applicant pool:

- **Degree classification:** The bursary's academic requirement is oddly more stringent than basic physics ITE entry. This relies on the premise that degree class predicts teacher quality; however, although research on this is limited, prior qualifications do not clearly predict later effectiveness.⁶² While baseline subject knowledge matters, it must be matched by communication skills, passion, and pedagogical content knowledge.⁶³ These are not linked to degree outcomes; many excellent STEM teachers holding 2:2 or 3rd class honours and ordinary degrees could help address current teacher shortages.⁶⁴
- **Employment and education gaps:** The requirement to have worked three of the previous seven years, and to have left full-time education at least three years prior, excludes qualified candidates who took time out for personal circumstances, like caring responsibilities. Broadening eligibility would attract valuable skills to enrich and diversify the teaching community.
- **Timing uncertainties:** Bursary awards are not confirmed at the start of the ITE recruitment cycle, creating financial uncertainty that dissuades prospective applicants.
- **Depreciated value:** The bursary sum has never tracked inflation. Instead, it was cut from £20,000 to £15,000 in 2025, making it worth less than half of the £31,000 equivalent currently available in England.

By retaining unduly restrictive criteria and offering a reduced sum far below England's baseline, the bursary remains significantly less impactful than it could be.

Targeting bursaries for subjects with shortages

Focusing teaching bursaries explicitly on key shortage subjects like physics is a vital strategic imperative for Scotland to maximise the impact of public funding and stabilise a fracturing teacher supply pipeline.

Evidence from workforce supply interventions shows that high-value, subject-specific bursaries successfully stimulate recruitment because they alter the short-term financial calculation for both career changers and debt-conscious graduates, directly lowering the barrier to entry.⁶⁵

By restructuring Scotland's bursary schemes to offer competitive, inflation-protected funding specifically for fields with severe recruitment deficits, policymakers can effectively channel talent directly to the classrooms that need it most, disrupting chronic, long-term staffing shortages.

⁶⁰ <https://www.iop.org/sites/default/files/2025-09/The-physics-teacher-shortage-and-addressing-it-through-the-3Rs-Retention-Recruitment-and-Retraining-England.pdf>

⁶¹ www.skillsdevelopmentscotland.co.uk/media/yvog1ad/teaching-bursary-in-scotland-2024-evaluation-report-corporate-site.pdf

⁶² "Research shows that teacher effectiveness is largely uncorrelated with the teacher's own educational qualifications", from "Understanding teacher effectiveness to raise pupil attainment", S Burgess, IZA World of Labour (2019), at <https://wol.iza.org/articles/understanding-teacher-effectiveness-to-raise-pupil-attainment/long>; "there is little evidence that those characteristics most often used in hiring and salary decisions, namely teachers' education and experience, are crucial for teacher quality", from "The Impact of Teacher Subject Knowledge on Student Achievement: Evidence from Within-Teacher Within-Student Variation", Metzler and Woessmann (2010), CESifo Working Papers, at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1634795

⁶³ "What makes a good physics teacher?", de Winter and Airey (2020) Physics Education (55) 015017 (see <https://iopscience.iop.org/article/10.1088/1361-6552/ab5215/pdf>); and "Those who understand: knowledge growth in teaching", Shulman (1986, vol 15 no. 2) Educational Researcher, 4–14 (see https://depts.washington.edu/comgrnd/ccli/papers/shulman_ThoseWhoUnderstandKnowledgeGrowthTeaching_1986-jy.pdf).

⁶⁴ Becoming an expert teacher: novice physics teachers' development of conceptual and pedagogical knowledge, Angell, Ryder and Scott, working report of the University of Leeds Physics Enhancement Programme Evaluation (2007): see <https://essl.leeds.ac.uk/education-research-expertise/dir-record/research-projects/812/physics-enhancement-programme-pep-evaluation>

⁶⁵ "The impact of training bursaries on teacher recruitment and retention: an evaluation of impact and value for money", McLean, Tang and Worth (2023) at <https://www.nfer.ac.uk/publications/the-impact-of-training-bursaries-on-teacher-recruitment-and-retention/>

Preference waiver

The preference waiver is an optional mobility bonus for teachers entering their probationary year who agree to be placed in any of Scotland’s 32 local authorities rather than choosing their preferred locations. The Scottish Government uses this financial incentive to direct new educators to rural, remote, or deprived areas where vacancies are most persistent and school environments can be more challenging. However, data suggests that ITE graduates are choosing this option less frequently⁶⁶, indicating a clear limit to the geographic flexibility a financial incentive can buy.

Remote schools allowance / Distant islands allowance

The Remote Schools Allowance is paid if you teach in a school that is designated as “remote.” There are two tiers depending on the school’s isolation:

Category	Definition	Annual Amount (From April 2025/6)
Category A	Most remote schools	£3,819
Category B	Slightly less remote schools	£2,037

Figure 8: Remote Schools Allowance

The Distant Islands Allowance is paid to teachers working in the island councils (Shetland, Orkney, Western Isles) or specific islands within other councils (e.g., Inner Hebrides). From October 2025, this amounts to £2,997 per annum.

It is possible to “double dip” allowances if a teacher works in a school that is both in an island community and designated as remote. Consequently, a probationer choosing the preference waiver and being allocated to a remote school, from August 2026 could receive a total one-year package of £50,975. This total is comparable to a qualified teacher with four years’ experience.

4.4 Career changers

Factors weighing for and against

Career changers represent a vital recruitment opportunity, bringing the credibility of direct workplace experience. They can speak authoritatively about private-sector physics careers, and their skills, such as project management, leadership, and conflict resolution, position them well for career progression in education.

Teaching offers intrinsic rewards through “lightbulb moments” and the fulfilment of inspiring the next generation to engage with a beloved subject and solve future societal challenges. In the classroom, delivering a broad curriculum to a diverse range of pupils can offer a more engaging and stimulating challenge than focusing on a singular industrial task. Furthermore, career changers are often attracted by teaching’s generous holiday structures, pension provisions, and job security.

Many career changers have strong subject knowledge and professional experience but face barriers, including a loss of income during initial teacher education and uncertainty about their employment location, which may not suit those who are less mobile (e.g. those with families, and/or homeowners). Supporting career changers requires clear pathways into teaching, including financial support that reflects prior earnings, and strong mentoring during their transition.

Teaching often presents a severe cultural and environmental shock for those from non-school backgrounds. Unlike flexible adult workplaces, teaching offers virtually no diary control once timetables are set, and non-contact time is tightly restricted by mandatory meetings, administrative demands, and bureaucratic requirements. Although Scotland’s Curriculum for Excellence offers flexibility for career changers to integrate their real-world experience, a clearer curriculum knowledge framework would better support them by significantly reducing lesson planning burdens.

Because physics teachers must teach all Broad General Education science subjects, they often need support and professional development to deliver confidently the unfamiliar biology and chemistry topics outside their core expertise.

Maintaining a constant official persona towards pupils also requires significant skills and effort, and managing pupil behaviour, such as disengagement, poor diligence, and direct challenges to authority can be one of the most challenging aspects of teaching.

Finance

Despite all the available financial incentives, it can still be a financial shock for those with an industry background to become a teacher. The Teaching Bursary is not a permanent supplement, although it can ease the transition, eventually a new teacher will be on a newly qualified teacher’s salary, which could be substantial drop compared to earnings in the private sector. There can also be delays in receipt of the bursary which puts the career changer out of pocket for initial expenses and at a cash flow risk, including course fees (if not paid by the Student Awards Agency), housing and/or travel.

Pathways

Alongside the financial element, there could be easier pathways to support career changers, principally Subject Knowledge Enhancement (SKE) courses. These are intensive, tailored programs designed to bridge the gap between a candidate’s existing degree and the depth of specialist knowledge required to teach a specific subject effectively. For example, this would be relevant for someone who held a degree in a related field like engineering, chemistry, or mathematics, but who lacks the academic qualifications required, specific content knowledge, or practical laboratory experience to teach the subject well.⁶⁷ By focusing on core principles SKEs can ensure that participants enter their Professional Graduate Diploma in Education with the confidence to simplify complex theories and handle classroom demonstrations and group practical work safely.

For recruitment in Scotland, SKEs could serve as a vital pipeline for retraining professionals from industry or supporting career changers who are otherwise deterred by rigid entry requirements or lack of confidence in some curricular areas. Successful models succeed because they blend subject knowledge and specific teaching skills, learning not just the physics, but how to teach it to a 14-year-old.

The most effective programmes prioritise flexibility (allowing for part-time or distance learning), bursary support to offset the cost of career switching, and mentorship from experienced physics educators. This combination of financial accessibility and practical application is what could turn a subject enthusiast into a classroom-ready specialist.

⁶⁶ <https://www.tes.com/magazine/news/general/fewer-probationer-teachers-willing-work-anywhere-scotland-next-year>

⁶⁷ <https://spark.iop.org/framework>

4.5 International comparisons

Teacher recruitment and retention is a global challenge affecting developed economies aiming for technological success.

- USA: The Physics Teacher Education Coalition reports⁶⁸ that only 10% of the required physics teachers are currently on training pathways
- Germany: Facing its worst teacher shortage in 50 years, the government is expanding pathways for career changers into high-demand technical subjects like physics⁶⁹
- Australia: The 2022 National Teacher Workforce Action Plan⁷⁰ introduced targeted STEM bursaries to combat severe shortages and an aging teacher profile; currently, 20% of physics classes are taught by non-specialists

A 2024 UN High-Level Panel⁷¹ identified three universal systemic challenges driving these shortages:

- The wage gap: In developed nations, physics graduates face massive incentives to follow higher paying jobs in private industry
- Subject isolation: Working in small or single-teacher departments creates isolation, heavy workloads, and a lack of camaraderie, which accelerates early-career attrition
- The vicious circle effect: Staffing shortages force non-specialists to teach physics, lowering student engagement and shrinking the downstream university pool of future teachers

Several international successes offer proactive models for Scotland to consider when addressing STEM teacher shortages:

- USA: PhysTEC’s PTEPA Rubric provides a framework based on “thriving” programmes, using active “teachers-in-residence” to mentor university ITE students
- Singapore: Deemed the gold standard by the OECD, its Teaching Scholars programme⁷² restricts eligibility to the top 30% of STEM graduates and offers a Master Teacher track for career and salary progression without entering school leadership
- Germany (Brandenburg): Career changers with relevant experience can teach part-time on full pay alongside completing 500 hours of on-the-job pedagogical training within 13 months, supported by open visa routes for international bilingual teachers⁷³

These models highlight the proactive intervention required by national agencies to transform the STEM workforce. Data from the OECD’s TALIS 2024 study⁷⁴ underscores that systems with higher retention, like the Netherlands and Finland, explicitly lower teacher stress. The data reveals that teacher retention is consistently higher in educational systems that:

- Reduce class contact time to allow for in-week preparation
- Avoid constant, unsupported curriculum reform churn
- Offer flexible employment patterns and make pay competitive with alternative graduate careers
- Provide structural support for diverse learning needs rather than leaving classroom teachers to handle that pressure alone

⁶⁸ <https://phystec.org/report-card/>

⁶⁹ www.cedefop.europa.eu/en/tools/timeline-vet-policies-europe/search/28144

⁷⁰ www.education.gov.au/national-teacher-workforce-action-plan

⁷¹ www.un.org/sustainabledevelopment/blog/2024/02/teaching-profession-recommendationteaching-profession-recommendations/

⁷² www.moe.gov.sg/careers/teaching-scholarships-sponsorships

⁷³ See ““Lateral entry as a teacher in Brandenburg: requirements and opportunities”, Brandenburg Skilled Workers Portal, at www.fachkraefteportal-brandenburg.de/en/specialists-magazine/magazin-detailansicht/lateral-entry-as-a-teacher-in-brandenburg-requirements-and-opportunities. Other German states (Bundesländer) have different requirements, but the teaching shortage in STEM subjects including physics is seen to varying degrees across the country.

⁷⁴ www.oecd.org/en/publications/results-from-talis-2024_90df6235-en.html

4.6 Conclusions and recommendations on recruitment

There is a severe, compounding recruitment crisis in Scotland’s secondary physics teacher pipeline. This acute deficit stems from physics undergraduates opting for more lucrative private-sector roles and avoiding the difficulties associated with teaching.

While baseline starting salaries are initially competitive, Scotland’s current interventions to boost recruitment in shortage subjects are limited. Left unaddressed, this long-term under-recruitment forms a self-reinforcing loop that reduces secondary pupil engagement, narrows the university talent pool, and threatens the wider Scottish STEM pipeline as well as that for future physics teachers.

To address the chronic recruitment challenge, the ten-year physics teaching workforce study should include:

- 12. Commission a comprehensive research study into the low throughput from physics undergraduates into teaching
- 13. Reform the teaching bursary by broadening eligibility criteria, at least matching its value to England’s, and align timings with the ITE recruitment cycle
- 14. Enhance teaching bursaries specifically for subjects experiencing the most acute shortages, and in particular shift the preference waiver into a staged retention premium spread over the first five years post-qualification
- 15. Create transitional financial protections for career changers
- 16. Change the funding model for universities to ensure there is viable provision for ITE in shortage subjects in all areas of Scotland
- 17. Provide subject-specific support for career-changing recruits, including Subject Knowledge Enhancement courses



Section 5: Retraining – Building Capacity from the Existing Workforce

5.1 The case for retraining

Retraining existing teachers to gain accredited physics expertise is one of the most accessible, cost-effective ways to increase capacity because qualified teachers have already succeeded in obtaining professional qualifications and registration and may be settled in a school environment. Furthermore, professionals from other teaching disciplines can be expected to already possess the general pedagogical knowledge and knowledge of the Scottish education system you would expect of any teacher. Retraining existing teachers can reduce reliance on teaching outside specialism, improve retention by increasing confidence and job satisfaction, and build resilience in small departments.

Increasing the number of dual-qualified teachers could also provide schools with the flexibility to deal with varying year on year subject demand and increases in teacher non-contact time. In one sense this is a measure which shifts rather than adds capacity, and so could not be a complete solution by itself, but it could alleviate areas of greatest need, of which physics is one.

5.2 Additional teaching qualifications in physics

The General Teaching Council for Scotland (GTCS) provides routes to additional subject registration, but uptake in physics is limited. Barriers include cost, time, and limited availability of structured programmes.

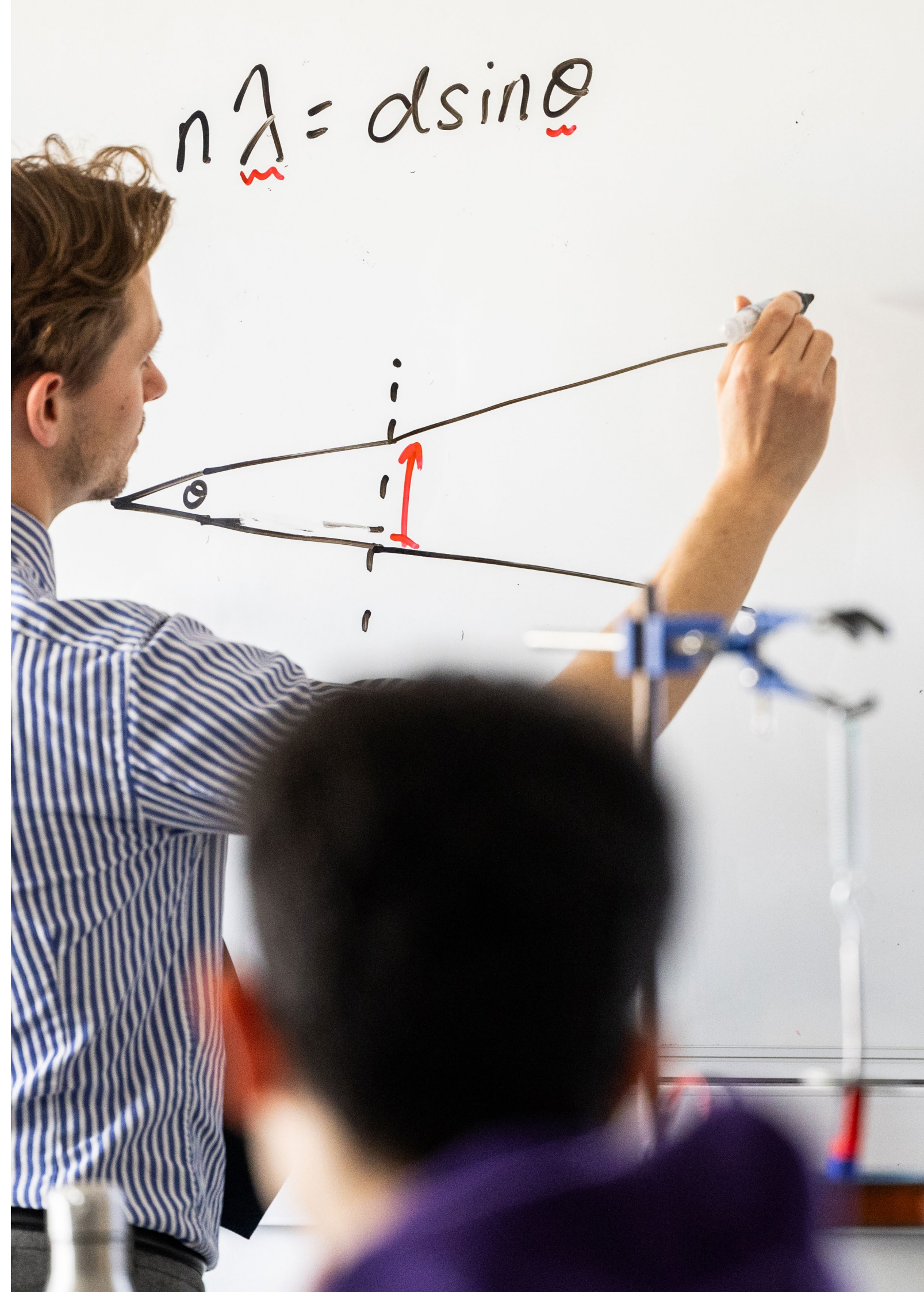
A targeted physics retraining scheme of the kind the IOP has recommended for England could be viable and effective in Scotland, provided it was structurally mapped to the GTCS's Additional Registration framework. This allows existing fully registered teachers to add a secondary subject via an employment-based route. The solution to this involves:

- **A new learning framework.** The Scottish Government, in partnership with Scottish universities, should establish and fund part-time blended learning courses for existing teachers explicitly designed to meet the criteria for GTCS Additional Registration. A bespoke offer would be needed to achieve the required minimum of 80 Scottish Credit Qualifications Framework (SCQF) credit points in that discipline (with at least 40 credits at SCQF Level 7 and 40 at Level 8). To allow teachers to gain certification without leaving their current school, this could involve a blend of flexible online modules and release for intensive courses on practical work.
- **Looking beyond the scientific disciplines into other STEM subjects.** A disincentive for teachers of mathematics and technological subjects who are interested in gaining additional registration in physics is the normal expectation that physics teachers teach biology or chemistry content as part of general science teaching. The learning framework described above, together with appropriate timetable changes, could be promoted to maths, computer science, and other technologies teachers, and designed to allow greater transfer between physics and the other STEM subjects. These teachers could become jointly registered and teach both physics in the senior phase and other STEM subjects simultaneously. Greater levels of joint subject registration would support interdisciplinary learning across the STEM subjects and give schools more flexibility to address staff absences and departures where there are limited supply options. Local authorities, school leaders, and faculty heads should work together to develop innovative approaches to fit such joint subject teachers into school structures and timetables.
- **Mandating a half-day release protocol.** Teachers who express an interest in this retraining route should be entitled to a mandatory half-day per week structural release (i.e. 20 days over a year) to complete their studies, paired with a mandatory one-year subject-specific mentoring programme. The greatest failures of retraining programmes occur when teachers lack release time to study or to finish all modules. Since the GTCS also requires provisionally registered additional-subject teachers to complete a recommended 20 days of assessed teaching, a protocol to enable in-school or cross-school mentoring from an experienced physics teacher would enable transition into full registration in physics, as well as providing crucial support to teachers switching subjects.

This may require dedicated national funding for local authorities to enable this. Providing a ring-fenced budget ensuring a 10–20% timetable reduction would support teachers to develop a physics teaching identity and help overcome the routine time and support barriers. Supporting the development of an identity as a teacher of a particular subject helps integrate them into that community and provides a sense of belonging which will increase the likelihood of their retention within the profession.

A ten-year strategy should consider the following elements:

18. Develop courses to enhance teachers' subject and pedagogical knowledge in physics to support teachers already qualified in other subjects to meet the GTCS Additional Registration requirement for physics
19. Ring-fence time to allow teachers already qualified in other subjects to retrain in an additional subject
20. Flexible timetabling arrangements to allow teachers in technology, engineering, and maths subjects to teach physics without an expectation to teach biology and chemistry in BGE to better utilise their expertise





Section 6: System Foundations

6.1 Data and workforce intelligence

Elsewhere in this report, we have identified data gaps on:

- robust, long-term evidence linking secondary school physics provision directly to subsequent pupil destinations and regional economic skills demands
- why eligible physics graduates choose not to apply for Initial Teacher Education (ITE)
- the out of subject specialism teaching which is occurring in Scottish schools, and which may obscure the true scale of the physics teacher shortage
- the number of teacher vacancies, both advertised and ‘hidden’, across Scottish schools

National data collection mechanism to capture each of these are essential for effectively targeting policy interventions where they are needed most. However, they are not the only data gaps. We must also routinely identify schools with limited or no specialist provision, track recruitment, attrition, and retraining outcomes, and determine real need to allow all pupils who wish to study physics have the opportunity. Unless we do so, we will continue to lack a granular, accurate picture of areas where, and the extent to which, our teaching workforce needs improvement, and this will hamper our ability to address the challenges and plan.

6.2 Systemic factors

The persistent shortage of physics teachers in Scotland is a crisis that national planning and monitoring bodies are failing to resolve. Although organisations like the Teacher Workforce Planning Advisory Group (TWPAG) and the Strategic Board for Teacher Education (SBTE) have long recognised this “acute” and “persistent” deficit, their reactive models and siloed operations have allowed the problem to worsen.⁷⁵

Reactive modelling and contradictory policies

The education system’s forecasting tool is flawed. TWPAG relies on historical and incomplete data that ignores the industry “leaky bucket” effect, where physics teachers regularly exit the classroom for more lucrative private-sector roles. This approach led to policy and messaging contradictions in 2025 and 2026, when the group recommended cutting overall ITE places due to falling pupil numbers despite the continued under-recruitment in shortage subjects. It is important that teacher planning decision making does not undermine wider STEM recruitment goals and the need to address the critical physics skills required by the economy and society.

Stagnant initiatives and failures to deliver

Existing financial incentives and political pledges are failing to stem the tide. Despite investments in career-changer bursaries and preference waivers, physics teacher recruitment remains on the brink of collapse. Teacher unions have been extremely critical of the Scottish Government’s failure to deliver its 2021 manifesto pledge to hire 3,500 additional teachers. While overall headcounts have flatlined, actual teaching capacity in shortage subjects such as physics has reduced. More radical approaches are required.

Local funding and placement chokepoints

The teacher pipeline is inhibited at the local level by budgetary conflict and capacity bottlenecks. The funding pattern is Scottish Government setting legislative and strategic direction, and local authorities

⁷⁵ <https://ssta.org.uk/teacher-shortages-stem-from-workforce-planning-failures-and-deteriorating-working-conditions/>

managing the teaching workforce. However, with limited funds and limited capacity to change the overarching policy direction, local authorities find it difficult to offer enough permanent, high-quality contracts needed to meet teaching needs.

Universities have difficulty finding schools willing to host physics student teachers because overstretched departments lack the mentor capacity to support them, a bottleneck which could hamper efforts to close the gap even if recruitment increases. Innovative solutions, including subject-specific mentoring for teachers in neighbouring schools, perhaps using the incentive of Lead Teacher roles, could help address such bottlenecks.

Teachers, whether entering through an ITE or retraining route, are likely to feel welcomed into the teaching profession and therefore be more likely to be retained if they receive good quality mentoring. School placements during ITE and the Teacher Induction Scheme during a teacher's probationary period allows for this. However, there is little or no systemic support for teacher mentors in schools. Improved training for mentors so that they understand their role and how to best support a beginning teacher, and time to support their mentees should be provided and protected.

Siloed responsibilities and lack of system leadership

The ultimate barrier to solving the physics teacher shortage is an absence of overall systemic ownership and leadership. Recruitment responsibilities are overly siloed with the Scottish Government, local authorities, the Scottish Funding Council, and universities all playing distinct roles with at times, different priorities. Recruitment targets in the STEM subjects have not been met for many years, and this can only be addressed through strong leadership driving a coherent long-term approach. No single actor takes responsibility for the entire system. Issues related to teacher retention are left unaddressed.

Unless physics teacher shortages are addressed, we will see disappearing school physics courses disproportionately damaging the opportunities for young Scots in disadvantaged and remote communities thereby creating a two-tier physics education system.

6.3 Conclusions and recommendations on system foundations

A ten-year strategic approach, founded on the 3Rs of retention, recruitment and retraining needs to be underpinned by strong foundations. The long-term approach is necessary because addressing physics teacher shortages requires long-term planning, and educating a physics teacher takes several years. Experience from England and Wales demonstrates that recruitment-focused interventions alone do not stabilise the workforce. Retention can deliver faster and more reliable gains, and retraining can provide cost-effective capacity if well-designed. Addressing all three aspects is essential to any successful approach.

As part of the ten-year strategy some actions can be enacted immediately that represent quick-wins. Bursary provision can and should be reformed immediately. Research and improved data collection could be commissioned immediately so it could be acted upon as soon as possible. Entitlements to time out of school contact for retraining and improving mentoring could be organised within a year and retraining programmes developed and introduced within two years.

Systemic structural challenges in the management and strategic direction of Scottish education may take longer, but a jointly developed ten-year strategic approach is most likely to make a sustained and sustainable difference in making workforce planning proactive and based on a system-wide analysis with shared objectives and understanding. It will help resolve funding and operational challenges where and when they arise.

The ten-year physics teacher workforce strategy must align with wider policy and practice, national non-contact time commitments, and regional and national economic skills strategies. It must also be future-proofed against other ongoing education reforms, including the current Curriculum Improvement

Cycle and forthcoming qualifications and assessment changes in the senior phase. Without this strategic alignment, individual initiatives risk being undermined by wider system pressures and competing initiatives.

However, the continuation of education reform should not be used as an excuse to postpone adopting this workforce plan. The stark, persistent shortfalls in the physics teacher workforce require resolution regardless of which curriculum and assessment arrangements are adopted. Additionally, inadequate physics teaching capacity puts enactment of wider educational reforms in physics at risk.

Failure to act will further reduce access to physics education, contribute to Scotland's long-standing issues of regional and socio-economic inequality and educational attainment gap.

Equally, placing constraints on Scotland's future skills base threatens Scotland's future economic growth and prosperity.

The IOP considers these risks to be avoidable with timely and sustained action, but we all must be brave, be prepared to seek innovative solutions, and to act now.

A ten-year strategy should consider the following elements:

21. Collect improved data on teacher vacancies, those teaching outside their specialism, and the teachers needed to deliver the curriculum required by wider national policy and future demands
22. Improve collaboration and policy alignment between all agencies with a role in teacher retention, recruitment, retraining, employment, and workforce planning
23. Training and protected time for teacher mentors to help ensure those recruited and retrained are then retained and developed
24. Collect robust, long-term evidence linking school physics provision to pupil destinations, regional skills demand, and national policy needs; closing this gap is crucial for effectively targeting policy interventions.

