Cyflwynwyd yr ymateb hwn i'r Pwyllgor Plant, Pobl Ifanc ac Addysg ar Llwybrau at addysg a hyfforddiant ôl-16

This response was submitted to the Children, Young People and Education Committee on the Routes into post-16 education and training

RET 42
Ymateb gan: Y Sefydliad Ffiseg
Response from: Institute of Physics (IOP)

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1. Introduction and executive summary

Introduction

1.1. The Institute of Physics (IOP) is the professional body and learned society for physics in the UK and Ireland, representing 21,000 members. It seeks to raise public awareness and understanding of physics, inspire people to develop their knowledge, understanding and enjoyment of physics and support development of a diverse and inclusive physics community. As a charity, it has a mission to ensure that physics delivers on its exceptional potential to benefit society.

1.2. Physics benefits us all. It provides essential skills and knowledge that we will depend upon ever more in years to come. Physics is not just the source of inventions and ideas, but also how the country's economic health can be secured. Wales has an established research and development (R&D) base, representing both employment and growth opportunity, but likely held back by significant issues in the education and skills system. It is home to many internationally leading researchers with key roles in major international collaborations and it serves as a base for many businesses that have built significant success on physics-related knowledge and technologies. Wales also has its niche physics demands. For example, in south Wales, semiconductor manufacturers depend on physics-trained workers.

Executive summary

a) When deciding their post-16 choices, learners should have access to careers advice that provides an accurate assessment of their options and clearly signposts available routes. Currently careers advice for physics-related routes is insufficient with some careers advice on Careers Wales providing extremely poor advice on physics and further perpetuates negative stereotypes.

b) All learners should have access to advice on careers in physics which challenges and does not reinforce stereotypes about the type of people who do physics. We know that girls, disabled people, ethnic minority students and students in lower socio-economic groups are underserved in physics.

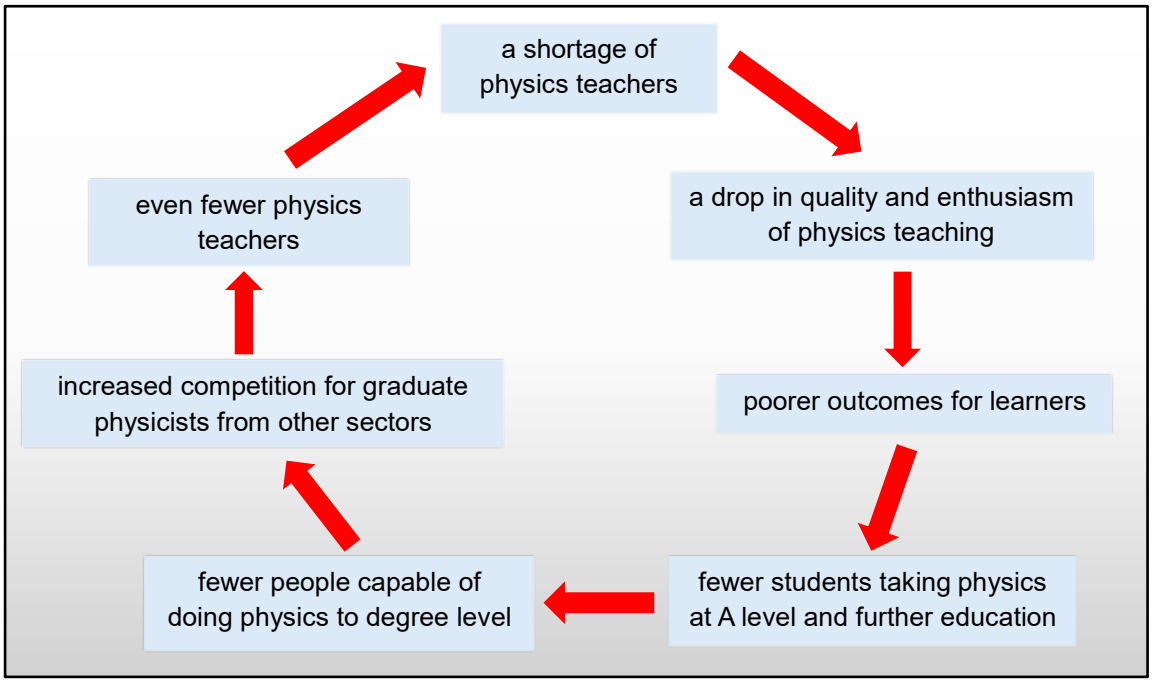
Stereotyping particularly affects girls at all ages but especially when they come to make their post-16 choices. This response highlights problems with participation in physics at post-16, particularly amongst girls. Our response highlights IOP and Gatsby resources for use when supporting learners to consider post-16 options.

c) All learners at secondary school in Wales should have access to a physics-specialist teacher who is an expert in their subject and can inspire and signpost students into post-16 physics-related routes. Learners are currently missing out due to the severe shortages in the number of physics teachers – there are fewer physics specialist teachers than there are secondary schools.

d) All learners should have the opportunity to progress in science beyond the age of 16. The new GCSE system in the sciences set to be implemented will not guarantee this. Welsh Government and Qualifications Wales should work together to deliver a single pathway through the sciences at GCSE, ensuring all learners can progress.

e) The number of students in Wales progressing from A level to study physics in university is too low to meet the skills demand, as is the number of students who study physics at university in Wales. In 2019/20, Wales had the lowest number of physics A level entries per head of population in the UK at 311 entries per million compared to England's 635 per million. For 2015/16 to 2018/19 only 26% of physics and astronomy students in Welsh universities were from Wales. For all other subjects combined, 43% of students were from Wales. This has a knock-on effect for the financial sustainability of university physics departments which are facing significant challenges.

f) The challenges outlined in our response highlight the vicious cycle effect physics is experiencing in Wales:



g) Data is a persistent challenge across the board in supporting policy analysis and recommendations for physics-related routes in Wales. Equalities data in physics-related apprenticeships such as engineering (beyond gender) is lacking, particularly in Welsh language settings. Assessing the strength of the physics teacher workforce by school and language medium is all but impossible as the data on this scale does not exist. Even on existing data it is unclear the number of teachers in schools a) with a physics degree or physics PGCE and b) the qualifications of those teaching physics who are not physics-specialists.

2. Quality of information given to learners about the full range of post-16 options

2.1. A learner's post-16 options should be guided by aspirations and not stereotypes. Learners should be informed of their options based on their goals, subject choices, career intentions and the post-16 routes available. Physics-related routes should be available to all learners. IOP made this recommendation to Dr Hefin David MS's Transitions to Employment report.[1]

2.2. Unfortunately, from an early age too many young people are denied the opportunity to pursue physics because of misconceived ideas about what physics is, or outdated stereotypes and prejudice about who can study physics. As a result, too many young people are made to feel that they cannot do physics, or they just do not fit in.

2.3. In 2024, physics was the second most popular A level subject for boys, and the 16th most popular subject for girls. Girls made up only 22.4% of the physics A level cohort.[2] For physics-related apprenticeships the gender balance divide only worsens. Around 6-11% of physics-related apprentices in Wales are girls.[3]

2.4. The IOP has heard from schools and further education representatives in Wales that there is insufficient information on the range of post-16 options in physics-related roles.[4] This in-part stems from the sub-par and off-putting information provided by Careers Wales, compounded by the lack of specialist physics teachers in Wales inspiring students in physics.

[1] David, H. 2023. Transitions to Employment. Cardiff: Welsh Government, p. 27.
[2] StatsWales. 2024. A level entries and results by subject group. Cardiff: Welsh Government.
[3] Institute of Physics. 2023. The Physics-related Apprenticeship Landscape in the UK and Ireland. London: Institute of Physics, p. 68. (This statistic can fluctuate year to year as the numbers are so low. It is known to range between 6-11% depending on the year, our report references 6% but in 2019/20 it was 11%).
[4] Institute of Physics roundtable on the skills gap. November 2023. Cardiff.

2.5. There is a lack of physics-related skills routes through further education. The number of routes available across Wales for students to train in the physical sciences is limited in its offer.

2.6. The IOP supports a post-16 qualifications landscape that is coherent and equitable and prepares young people to progress into a range of careers and further and higher education in the physical sciences, and more widely.

Careers advice and work experience

2.7. All schools should be opening up post-16 physics-related routes for students as part of the Curriculum for Wales careers and work experience remit. The committee should be mindful of the fact that not all learners have an equal opportunity in their physics education in how it is taught, and they may not have access to physics-specialist teachers or exposure to physics industries and opportunities in further and higher education.

2.8. Physics is wide-ranging in its impact in the workplace and economy. The majority of physics-related jobs are in its application rather than in research roles and this takes place across a wide range of industry sectors, present in many parts and places. Learners should have access to up to date and accurate information on the true breadth and variety of options that physics opens up at all skill levels. Students are currently underserved as information about physics is presented to them as an elitist and academic subject.

2.9. Information and experiences should be provided to learners on the application of physics in the workplace and the career potential that being skilled in physics brings. Around 10% of Wales' economy is physics-powered and this has significant potential to grow with advances in physics-powered industries such as semiconductors, AI and net zero energy.[5]

2.10. Learners need to experience an engaging physics curriculum delivered by specialist physics teachers and be exposed to physics-related careers. This is where the provision of work experience and strong careers information is vital. Without physics curriculum, teaching and exposure to careers working in tandem, opportunities in physics will not be unlocked for learners.

2.11. Careers and work-related experiences guidance on the Hwb for the science area of learning promotes ideas around grounding learning in industry and tackling stereotypes from a young age.[6] The Curriculum for Wales offers

[5] Institute of Physics. 2022. The contribution of physics to the Welsh economy. Online: IOP.
[6] Hwb. 2024. Science and Technology: Designing your curriculum. Online: Welsh Government.

schools the opportunity to implement the Gastby careers guidance benchmarks in the delivery of careers guidance and experiences.[7] Careers Wales toolkit guidance for the Curriculum for Wales recognises the importance of career knowledge, skills and experiences in broadening a learners' horizons and opening up opportunities.[8]

2.12. Ensuring that schools deliver on the opportunities in the Curriculum for Wales by opening physics-related opportunities to all learners at post-16 is essential. When learners experience a strong equitable physics curriculum delivered by professionals and are shown its tangible benefits through links with industry, the physics profession and physics-related further and higher education, then this would be a significant step to ensuring routes into post-16 physics are open to all.[9]

Careers Wales

2.13. Careers Wales needs to provide better, more accurate and up to date information to young people about the opportunities available in physics-related roles. Currently, its physics webpage advising young people on a career path in physics is outdated, reinforces inequity and negative stereotypes about physics and vastly understates the role that physics plays in Wales' economy.[10]

2.14. The webpage contains:

- a restrictive definition of 'physics jobs' that does not convey the opportunities to young people.
- outdated imagery – Albert Einstein is not a relatable figure to most young people. The overlay with 'physics formulae' on top only serves to play on outdated concepts on what physics is and its role in young people's lives and Wales' economy.
- a low job demand profile - the job openings forecast for 'physicist' is lower than the Welsh Government's physics teacher ITE allocation targets. On this measure alone, the webpage has failed to convey the high demand for physicists.
- an overemphasis on university degree qualifications as the pathway into physics. This again plays on outdated preconceptions of what physics is and does not convey the opportunities available as described in para 2.16.

2.15. The webpage is at odds with almost all IOP advice and recommendations about making physics more accessible to young people.

[7] Gatsby. 2024. Gatsby Good Career Guidance Summary for Schools. Online: Gatsby.
[8] Careers Wales. 2024. Careers and work-related experiences (CWRE). Online: Careers Wales.
[9] Holman, J. 2017. Good practical science summary. Online: Gastby.
[10] Careers Wales. 2024. Job information: physicist. Online: Careers Wales.

2.16. Most damagingly, Careers Wales states there are just 65 jobs available in physics in Wales. IOP analysis as of 2020 (during covid) puts the number of physics-demanding roles in Wales at over 67,800.[11] This number has likely grown since. It must be made much clearer to learners at all levels the potential for physics at post-16 and for Careers Wales to shift their definition to 'physics-related' which far better represents physics' potential to students and its true value to the economy.

2.17. More than half of physics-demanding roles do not require a degree.[12] However, young people do not get a clear picture of technical pathways that could lead them to rewarding careers in physics. Some lists of the types of physics-related apprenticeships do exist, but there is not a clear pathway connecting a learner in school through to a technical route resulting in a career in a defined industry or organisation.[13] Provision is patchy across Wales.

2.18. An understanding of physics as it is applied in the workplace means around half of physics-demanding roles are in occupations which require intermediate level qualifications. The importance of physics in industries such as construction, manufacturing and infrastructure means there are many roles where the work relies on the application of physics knowledge but does not require a degree.[14]

2.19. Catapult Compound Semiconductor Applications (Catapult CSA) are delivering outreach to schools and learners in south Wales about the highly advanced physics-powered compound semiconductor cluster also located in south Wales.[15] The semiconductor industry faces significant skills shortages at all skill levels (para 3.6). Linking learners and schools to their local industries could open pathways for many young people across south Wales into skilled work. However, people must know about the types of jobs that are available to them if they are to seek a career in that area. Ensuring that schools and learners are aware of the physics-powered industries near them and how to link up and find pathways into this work is of huge importance.

Specialist physics teachers

2.20. Students who have a specialist physics teacher at school are much more likely to go on to study physics at post-16, opening huge career opportunities in

[11] Institute of Physics. 2020. Physics in Demand: The labour market for physics skills in the UK and Ireland. Online: Emsi Burning Glass, pp. 16.
[12] Institute of Physics. 2022. Unlocking the potential of physics skills. Online: IOP, p. 11.
[13] Planet Possibility. 2022. Physics Apprenticeships in Wales. Online: Planet Possibility.
[14] Institute of Physics. 2020. Physics in Demand: The labour market for physics skills in the UK and Ireland. Online: Emsi Burning Glass, pp. 48.
[15] Catapult CSA. 2024. Over 200 school students from Wales learn more about semiconductors. Online.

physics-powered industries. Specialist physics teachers are essential communicators of physics ideas and concepts in addition to demonstrating to students the real-life benefits of physics outside of school. Specialist physics teachers might be the single physics point of contact a learner may have. Sadly, many students in Wales do not have access to one.

2.21. There is a huge shortage of specialist physics teachers in Wales (see para 2.24) and not enough are coming through the Initial Teacher Education system to close the gap on the shortages. The Welsh Government is falling drastically short of its current target allocation in attracting physics specialists into teaching. Every year the targets are not met, the more we fall behind.

2.22. The IOP's report on supporting young people to change the world highlights the crucial role accurate information plays in young people and their family's perceptions about who can do physics. When learners were asked "where, if anywhere, would you, or have you previously, accessed careers/education choices information?" the top two answers were 'teachers' (43%) and 'careers advice provided by school' (40%).[16]

2.23. This suggests that having specialist physics teachers who are experts in their subject in combination with strong careers advice provided by the school are some of the most effective ways to communicate post-16 physics-related educational and career opportunities to learners.

2.24. Wales had fewer physics-trained teachers (174) than secondary schools (176) in 2024.[17] [18] Some schools may have several physics-trained teachers and many schools will have none. For 2023/24, seven specialist physics teachers qualified through Wales' Initial Teacher Education system.[19] The Welsh Government allocation number is currently 67.[20] This is 90 percentage points short of the allocation. 58% of secondary schools considered themselves understaffed for physics teachers in 2022.[21] This was much higher than any other nation in the UK. In 2024, only 43.8% of those teaching physics in

[16] Institute of Physics. 2020. Support young people to change the world. Online: Institute of Physics, p. 26.
[17] Education Workforce Council. 2024. Annual Education Workforce Statistics for Wales 2024. Cardiff: Education Workforce Council.
[18] Welsh Government. 2024. Schools' census results: January 2024. Cardiff: Welsh Government.
[19] Education Workforce Council. 2024. Initial teacher education (ITE) student results. Cardiff: Education Workforce Council.
[20] Education Workforce Council. 2024. Initial teacher education (ITE) intake allocations. Cardiff: Education Workforce Council.
[21] Royal Society of Chemistry. 2022. The science teaching survey 2022. Online: Royal Society of Chemistry.

secondary schools were trained in the subject and available data indicate that less than half has trained in the subject since 2014.

2.25. Wales' shortage of physics trained teachers means that students with an aptitude or passion for physics are missing inspiration and encouragement to realise their physics talents which could, in turn, prevent learners from following a physics career in a thriving sector. This could also prevent the physics sector in Wales from growing. The IOP has called for the Welsh Government to work with the Institute to identify a path forward to increase the number of specialist physics teachers in secondary schools in Wales.[22]

2.26. The IOP welcomes the Children, Young People and Education Committee's plans to hold an inquiry into teacher recruitment and retention. We will be responding to this inquiry in detail. We also welcome the Welsh Government's announcement on its strategic education workforce plan.[23] IOP is keen to support this work and be involved in conversations with Welsh Government on it going forward.

3. How effective careers support is at compulsory school age

3.1. Young people's decisions for post-16 study are greatly affected by gender stereotyping and gendered expectations of choices.[24] [25] Girls' subject choices are particularly affected by the biases of their environment (and the same may be true for some other underserved groups, albeit studies have not yet been carried out to validate this). Given existing biases about who does physics, this has an impact on the numbers choosing the discipline.

3.2. Careers advisors should be aware of the consequences of gendered choices for students. Special attention should be paid to material aimed at supplying careers advice to avoid incorrect messages about the breadth of opportunities or the relative difficulty of subjects, as seen in the Careers Wales information on physics (para 2.13). Attention needs to be paid to details, such as a consistent quality of presentation and the nature of photographs and illustrations that might reinforce stereotypes.

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[22] Institute of Physics. 2024. Briefing note to Members of the Senedd. Cardiff: Senedd.
[23] Welsh Government. 2025. Written Statement: Strategic education workforce plan. Cardiff: Welsh Government.
[24] Institute of Physics. 2013. Closing Doors Exploring gender and subject choice in schools. Online: IOP.
[25] Institute of Physics. 2013. Opening Doors: A guide to good practice in countering gender stereotyping in schools. Online: IOP.

3.3. Further resources with advice on how to achieve gender-inclusive teaching in physics are available from the IOP.[26] This includes information on communicating better careers information to girls.

3.4. There are many opportunities for learners to be inspired by physics in Wales and examples of good practice do exist. CMB Engineering offers apprenticeships at various levels of qualification within its business, and its leadership has first-hand experience of the value of apprenticeships. Apprentices are activities the company strongly values, with 95% of staff hired as apprentices remaining at the company.[27] However, it has been highlighted to the IOP that business engagement with Welsh schools is generally poor, with some exceptions of best practice as highlighted. The IOP has published evidence of strong employer engagement with schools and students.

3.5. South Wales' compound semiconductor cluster is at the forefront of global semiconductor manufacturing with the advanced compound chips rather than the standard silicon. Tensions are growing globally around the manufacturing and supply of semiconductor chips, both silicon and compound, with many countries turning to securitise the industry.[28]

3.6. There is growing global competition to protect the domestic supply of compound semiconductors. Wales' niche in this technology is at risk as its semiconductor cluster faces significant skills shortages and would benefit dramatically from an increase in the supply of physicists/people with physics-related knowledge. An IOP survey found 66% of physics innovators across all sectors reported suspending or delaying innovation activities in the past five years because of skills shortages.[29]

3.7. It is difficult to say, for example, whether learners in Newport know about and understand the opportunities for them in the compound semiconductor industry and the cutting-edge highly skilled work that goes on in their area.[30]

3.8. Catapult Compound Semiconductor Applications are doing outreach to schools in south Wales.[31] It would be valuable to understand whether this approach or other methods of engagement can be sustained and possibly formalised,

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[26] Institute of Physics. 2023. Limit Less resources for educators. Online: IOP.
[27] Institute of Physics. 2024. IOP Solving Skills One Year On: Partnerships powering apprenticeships. Online: IOP.
[28] Allen, G. 2024. Understanding the Biden Administration's Updated Export Controls. Online: Center for Strategic and International Studies.
[29] IOP/Royal Academy. 2023. UK Semiconductor Challenges and Solutions: Access to Design Tools and Licensing Access to Skills, roundtable report. Accessed: IOP: Online.
[30] IOP/Royal Academy. 2023. UK Semiconductor Challenges and Solutions: Access to Design Tools and Licensing Access to Skills, roundtable report. Accessed: IOP. Online.
[31] Catapult CSA. 2024. Over 200 school students from Wales learn more about semiconductors.

resulting in positive outcomes for the local area linking local learners to the semiconductor industry.

3.9. There is much room for improvement in linking schools with local physics-powered industry. This would provide benefits for learners in widening their opportunities and boost the supply of skilled people to strategic industries such as the compound semiconductor cluster.

4. Changes in routes post-18

Students choosing university

4.1. Not enough people are studying physics at A level, and by extension, not enough people are studying physics at university (see para 4.8 and 4.13). The decline in the number of physics graduates in Wales is a key limiting factor on physics teacher recruitment, let alone plugging the physics skills shortage in Wales. We simply do not have enough people coming through to make up the numbers. Routes into physics at higher education should be made more accessible to learners.

4.2. Restrictive routes through the sciences in school that do not open up post-16 choices for all learners will have the effect of reducing the number of students who do physics at A level and by consequence the number who do physics at university (see section 8).

4.3. Low provision in the number of physics-related routes through further education compared to biomedical sciences for example presents a challenge for higher education. The number of routes available across Wales for students to train in the physical sciences is limited in its offer and this prevents entry to higher education where other subject areas with stronger provision in further education do not struggle in the same way.

4.4. The Welsh Government and Qualifications Wales had the opportunity to open up post-16 routes when they proposed a single route through the sciences for all learners, with The Sciences (Double Award) GCSE. However, a decision was then taken to offer three routes related to the sciences instead. Two of these routes offer no progression to post-16 education in a scientific discipline and none of the routes are mandatory in the new curriculum.

4.5. This will place limits on the number of learners who do physics at higher education in Wales, not by learner choice but by the science pathway they are place onto.

4.6. Wales needs an increase in both the number of domiciled physics students and physics students from outside Wales. As the committee identified, participation rates in higher education from Welsh students is particularly poor especially when NEET data is considered. Wales has the lowest proportion of students in the UK choosing university as their post-18 option.[32]

4.7. From 2015/16 to 2018/19, 63% of students studying physics and astronomy at undergraduate level in Wales were from England compared to 36% for other subjects.[33] For this date range, 26% of students studying physics or astronomy are from Wales. Having more students from England than Wales, as physics or astronomy do, is not typical of Welsh universities. In all other subjects combined, 43% of students are from Wales and 36% from England.

4.8. In 2019/20, Wales had the lowest number of physics A level entries per head of population in the UK.[34] Wales had 311 entries per million. England had 635, Scotland 1,829 and Northern Ireland 595 A level physics entries per million.

4.9. IOP analysis carried out in 2021 showed that compared to other nations in the UK, Wales had the lowest proportion of female physics students in university at 24%.[35] In terms of students from Wales who go on to study physics at any university in the UK, around 75-80% are male in any given year.[36] This gender imbalance will be related to stereotypes that girls face in their formative years, in society, education and careers advice (see para 3.1).

University and Research Funding

4.10. There are eight universities in Wales. Three of these provide physics undergraduate courses (Cardiff University, Swansea University and Aberystwyth University). Some physics departments are facing significant financial challenges. The changes to the rules on international students have opened the universities in Wales to a funding crisis with some physics departments facing more competition from other universities for UK domestic students to cover the shortfall.

4.11. Further erosion of the physics higher education capacity in Wales could in turn threaten physics research and development, along with the growth and employment options they underpin across the wider Welsh economy.

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[32] UCAS. 2024. 2024 cycle applicant figures. Accessed: Online.
[33] IOP analysis. Available on request.
[34] IOP analysis. Available on request.
[35] Institute of Physics. 2021. Physics Students in UK Universities Data Brief. Online: IOP, pp. 15.
[36] Institute of Physics. 2023. Physics Students and Staff in UK Universities HESA dashboard 2021/22. Online: IOP.

4.12. Physics departments could be under threat from cuts too. Less funding to physics departments means they are less able to match fund UKRI funding, meaning one cut leads to further cuts down the line.

4.13. Wales' physics departments may now need to rely further on tuition fees. However, as the committee knows, the number of students entering university in Wales is in decline and the number of first year physics and astronomy students in Wales dropping from 255 students in 2023 down to 225 in 2024.[37] Wales' physics departments are seeing a decline in the number of undergraduates joining – both in real terms and relative to some physics departments in England.

4.14. For medical physics there has been a drop off in numbers across the UK, but Wales is now attracting relatively fewer applicants and students compared to universities in England. Some universities in England that were on par with Wales' medical physics student numbers in 2022 are now seeing an increase in medical physics student numbers. Whereas one medical physics course in Wales has seen student numbers drop from 15 in 2022 down to three in 2024.[38] This is a concerning decline.

4.15. It is important to consider the options young people have once they complete full time education. As of 2023, Wales had the lowest research spending per head of the UK nations and regions and was consistently ranking at or near the bottom of productivity tables. The IOP's own surveys show Welsh physics innovators have postponed or outsourced innovation activities.

4.16. Wales receives less investment funding per person than every region of England by at least half. Money received by Wales was just under 3% of UKRI's total funding in 2021-22.[39]

5. **Welsh-medium provision**

5.1. Data on the number of Welsh language physics-specialist teachers does not exist. We do not know the extent of the physics teacher shortage in Welsh medium schools and the impact this may have. For example, we do not know whether students in dual language schools face barriers in taking physics exams in the Welsh language. Anecdotally, we have seen cases of students

[37] UCAS. 2024. UCAS applicant market research data. Online [paywalled].
[38] UCAS. 2024. UCAS applicant market research data. Online [paywalled].
[39] UKRI. 2024. Geographical distribution of UKRI investment, financial year 2021 to 2022. Online: UKRI.

from Welsh language homes opting to take physics exams in English because of resourcing issues. However, data on this is much needed.

5.2. Similarly, exam data split by socio-economic background and ethnicity is vital. It would provide a clearer picture of outcomes in physics. Data and evidence should underpin decision making and help schools to understand their performance against the national average.[40]Currently, this data is not made available.

5.3. Two Welsh language medium students may have qualified in physics ITE in 2024.[41] This is almost certainly not enough people to cover the gap.

5.4. As so few physics students in Wales are Welsh language speakers this leads to obvious challenges for Welsh medium physics provision in schools as the chances of a non-Welsh student becoming a Welsh medium physics teacher are minimal.

6. **Equity of access**

6.1. Misconceptions around who can study or pursue a career in physics are shaped by the opinions of others and information they see around them. Other young people are denied the opportunity to study physics because of misconceived ideas about physics that they are told by people whose opinions they trust, and because of the prejudice and stereotypes that they experience because of who they are.

6.2. Many girls are told that physics is more suited to boys. Employers have serious concerns about the diversity of physics-related apprentices.[42] In 2021/2022 only 6% of new physics-related apprenticeship starts in Wales were women.

6.3. There needs to be concerted action from government and educators to tackle stereotypes and misperceptions about who can do physics. Young people and their families must receive correct information and encouragement from their community to consider choosing physics as a subject or career opportunity.

6.4. In England, low-income areas are less likely to have a physics-specialist teacher in their school. The data are not available in Wales to make a similar comparison. Where students in England do not have a physics-specialist

[40] Institute of Physics. 2020. IOP Limit Less report 2020. Online: IOP, pp. 16 & 23.
[41] Education Workforce Council. 2024. Initial teacher education results 2023-24. Cardiff: EWC, p. 7.
[42] Institute of Physics. 2024. IOP Solving Skills One Year On: Partnerships powering apprenticeships. Online: IOP.

teacher, they are three-times less likely to progress in physics at post-16, thereby missing out on the benefits a physics-related skill set offers for employment.[43] The situation may be similar in Wales, but the data does not exist.

6.5. Schools need to create an inclusive, equitable environment, to ensure that no young people are deterred from studying physics. Young people should be more exposed to local employers to understand the exciting local apprenticeship opportunities that are open to them.

6.6. Across the UK, many apprentices expect to have financial issues relating to their apprenticeship, particularly around transport and travelling to their training provider. [44] For apprentices in rural Wales who often must travel to reach a physics-related apprenticeship, these issues are only compounded.

7. Post-16 destination data

7.1. Physics-related apprenticeship data is difficult to discern beyond the main categories of industry areas such as 'engineering' due to the way it is presented. Equalities data is lacking also. Data on the number of ethnic minority apprentices in physics-related apprenticeships is not reported on. Beyond data on gender, we are lacking equalities data elsewhere.

8. Welsh Government's role

8.1. Physics knowledge and skills are crucial if Wales is to deliver on its potential to become a powerhouse for the green economy and boost its potential in high-tech industries such as AI and semiconductors. It is crucial that the Curriculum for Wales nurtures the next generation of physics professionals and scientifically literate citizens.

8.2. Welsh Government and Qualifications Wales can ensure this happens by reintroducing a single route through the sciences at GCSE and remove the Integrated Science (Single Award) GCSE from the examinations system. This would provide a single pathway at GCSE for all learners to have a fair and equal chance of progressing in physics and the sciences.

8.3. Too many young people have their future study and career options limited early in their school journey. This needs to change for the benefit of learners and

[43] Institute of Physics. 2024. The Institute of Physics' Response to the Curriculum and Assessment Review [England]. Online: IOP, pp. 7.
[44] Institute of Physics. 2024. IOP Solving Skills One Year On: Partnerships powering apprenticeships. Online: IOP.

society. Curriculum reform should open opportunities into post-16 routes for *all* learners, not limit them or close them down.

8.4. The Welsh Government and Qualifications Wales had the opportunity to do this when they proposed a single route through the sciences for all learners, with The Sciences (Double Award) GCSE but at the last minute opted for three routes related to the sciences instead. Two of these routes offer no progression to post-16 education in a scientific discipline and none of the routes are mandatory in the new curriculum. This will limit a learners' options as they come to choose their post-16 options. The single certificate science GCSE will not prepare students for A-level or give them a good grounding for scientifically aligned technical routes.

8.5. When there is more than one route through the sciences at this level, decisions about which route a learner follows are often taken by the school. These decisions do not always reflect what is best for the learner and denies many the opportunity to progress their science education beyond GCSE.

Current science route proposals from Qualifications Wales and Welsh Government	**Is post-16 progression possible?**
The Sciences (Double award)	Yes
Combined Science (Foundation double award)	No
Integrated Science (Single award)	No

8.6. We have a once in a generation chance to introduce equity to the sciences, plug the skills gap and open up apprenticeship, A level and higher education pathways in physics for all, but this opportunity is being thrown away as Qualifications Wales are pushing ahead with multiple routes through the sciences at GCSE. In June 2024, Qualifications Wales announced its decision to delay the implementation of the GCSE The Sciences (Double Award) until 2026. There is time to reset and for Qualifications Wales and Welsh Government to return to their initial decision of a single route through the sciences for the benefit of all learners.

8.7. The IOP advocates for a single route for all students in Wales through GCSE The Sciences (Double Award). Students would still study biology, chemistry, and physics separately and receive individual grades for each discipline by tier of paper completed. This approach would support students into post-16 science pathways and provide equal opportunities for all whilst aligning the sciences with other secondary school subjects by not categorising students at such an early age.