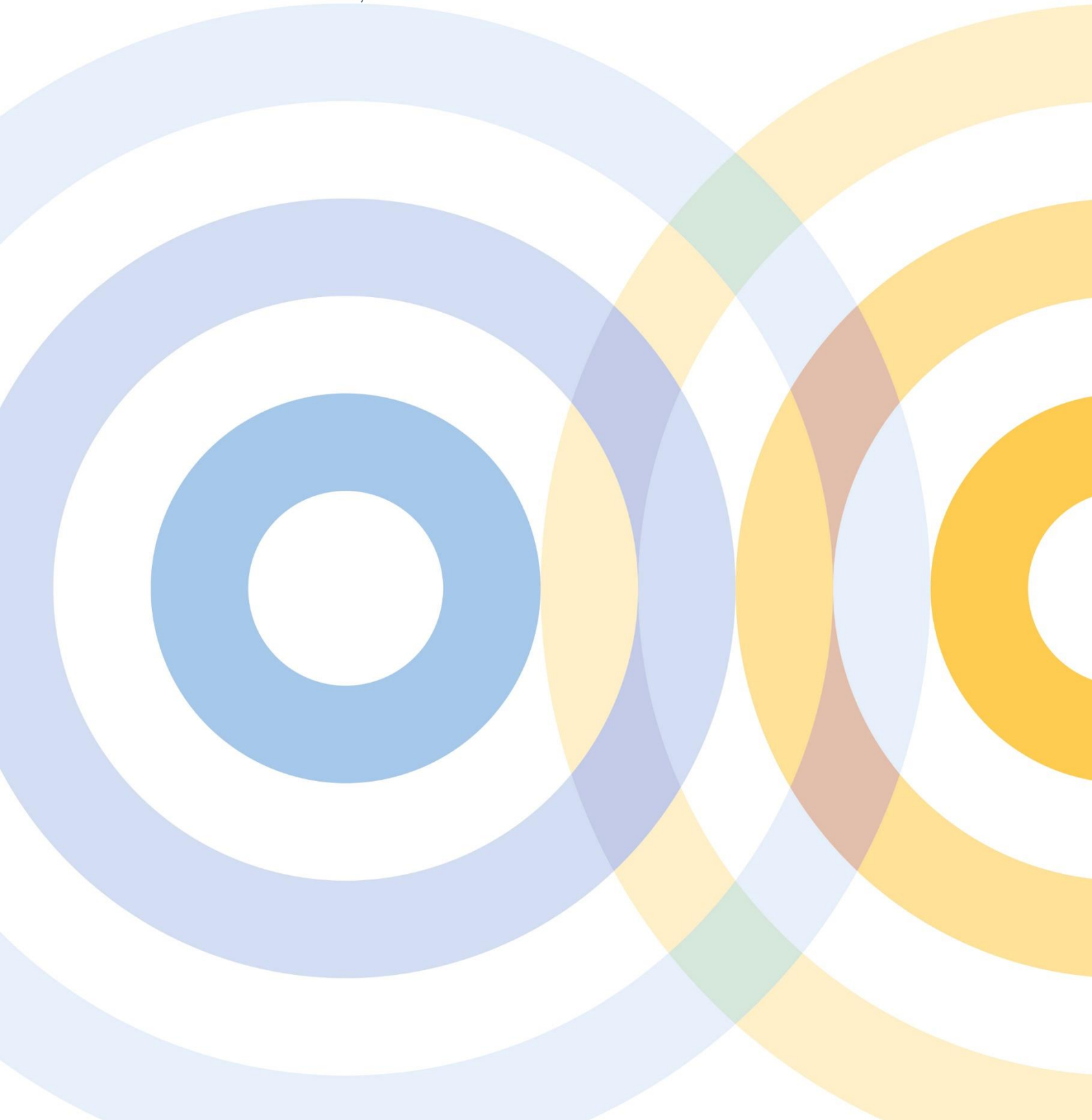




Ondata Research

Physics Mentoring Project Scoping Exercise Executive Summary

Laura Thomas, November 2022



Executive summary

Introduction

The Physics Mentoring Project (PMP) has been working with schools since 2019 with the aim of increasing the numbers taking A-level, especially amongst female learners. The project team is based at Cardiff University and partners are Aberystwyth, Bangor, Cardiff, Swansea universities, University of South Wales and Wrexham Glyndwr. Funding for the project has included Welsh Government, HEFCW and partner universities.

The project model has a strong theoretical framework and is based on evidenced best practice and research in relation to mentoring and STEM engagement. Mentoring projects have been shown to be more effective when being outcomes or aims driven, ensuring there is a clear focus for the relationship between mentor and mentee and that the young people participating are selected on the basis of these aims¹. For the PMP this means having the sessions focused around attitudes and intentions towards physics. Having a strong support system for mentors and high quality training also underpins success. Mentees are selected from those who are considering/might consider physics and who teachers feel have the capability to go to A-level.

There have been six cycles of mentoring to date in 2022 with cycles 7 and 8 planned for the 2022-2023 academic year. In each cycle a mentor (an undergraduate or postgraduate student) works either individually or in a pair with a group of six learners, typically in years 9 or 10. They participate in six weekly sessions and depending on the timing and circumstances these sessions can take place online or in person. The sessions aim to encourage mentees to connect physics to their own lives and interests. The mentors gather feedback from mentees and tailor the content and discussion to their interests using the Science Capital Teaching Approach as a basis². There has been a clear impact on mentors, mentees and schools³:

- For mentors, there has been skills development and confidence-building.
- For mentees, there has been a positive shift in attitudes towards physics and science-related careers.
- For schools, there has been an increased profile of physics and the opportunity to connect to a wider network.

English medium, Welsh medium and bilingual schools participate in the project with the PMP aiming to recruit Welsh-speaking mentors to ensure mentees can engage with the mentoring process in Welsh.

¹ Christensen, K.M., Hagler, M.A., Stams, G.J., Raposa, E.B., Burton, S. and Rhodes, J.E., 2020. Non-specific versus targeted approaches to youth mentoring: A follow-up meta-analysis. *Journal of Youth and Adolescence*, 49(5), pp.959-972.

² Godec, S., King, H., & Archer, L (2017). *The Science Capital Teaching Approach: engaging students with science, promoting social justice*. London: University College London.

³ All project evaluation reports and case studies can be found online here: <https://physicsmentoring.co.uk/about/evaluation-and-reports/>

Methodology

Given their success of working with young people in order to positively impact on intentions towards Physics A-level, the project team were interested in understanding how to broaden the aims of the project, particularly with reference to other post-16 routes into physics-related careers, with apprenticeships being one avenue of interest. Ondata Research were commissioned to undertake research with physics teachers, current school learners and college students and other stakeholders. In addition to interviews and focus groups, desk research was used in order to review the current situation in relation to the identified skills shortages in Wales and other relevant initiatives and policies.

Rationale

There is a need for more skilled people entering the workplace. In their most recent Business Barometer report in 2022, the Open University identified significant skills gaps in Wales⁴. This report is based on survey responses from over 1300 organisations across the UK and in terms of the general trends, the following points summarise the recent position:

- Gaps exist across a number of different employment areas and different levels of skills. Skills shortages have been “*exacerbated*” by the impact of Brexit and the COVID-19 pandemic but there are “*long-standing shortages*” which require a “*long-term strategic approach*” to address.
- “*Education is a huge enabler and has a vital role in easing and solving the skills shortage*” and that collaboration between “*employers, educational providers or policymakers, working together can reap rewards*”.
- Businesses reported a preference for recruiting locally and “*Increasingly, employers are seeking to develop a pipeline of future talent, through engagement with schools and careers activity in their local community*”.
- Recommendations included that “*young people will need greater guidance and support from employers to be better prepared for the world of work, through early business engagement with schools and having access to high-quality industry placements that help to apply and contextualise the learning*”.
- In order to address these issues, the report makes recommendations, including that “*young people will need greater guidance and support from employers to be better prepared for the world of work, through early business engagement with schools and*

⁴ Open University (2022) The Open University Business Barometer 2022 report Available: <https://www.open.ac.uk/business/business-barometer-2022-17062022>

having access to high-quality industry placements that help to apply and contextualise the learning”.

These organisations were also asked about barriers to recruiting and one of the key issues raised was that 16% overall said there was a ‘lack of apprentices applying’ – rising to 20% for manufacturers (Open University 2022).

In 2021 the Institute of Physics commissioned a report examining the labour market for physics skills across the UK⁵. The report summarised how physics is used in the labour market: *“Different industries draw on physics skills in differing combinations within their business models – and in all cases embedding physics within a set of professional and technical skills needed to perform the role.”* This report identified slow growth in Wales in physics-related roles (2.4% between 2010 and 2020 compared with 8.3% in Scotland and 12% in Northern Ireland) but that there is good representation across the different sectors relevant to physics, however there are *“niche physics demands: in South Wales semiconductor manufacturers like IQE and Newport Wafer Fab depend on physics-trained workers”*. In order to meet the needs of the semiconductor industry in South Wales, outreach and engagement with schools is seen as necessary in supporting recruitment. The Institute of Physics have carried out research into the demand for physics skills and found *“Demand for physics spans all skills levels: in fact, more than half (53%) of physics-demanding jobs do not typically require a degree, with a sizeable minority (46%) typically requiring intermediate-level qualifications such as A-levels, Highers, Leaving Certificates and apprenticeships”*⁶.

A common route into technical roles are apprenticeships, ranging from foundation (level 2) to degree apprenticeships (levels 6 and 7). All levels combine some kind of work-based training with study. Study can be on day-release from the workplace and occur in a range of settings, including further education colleges and universities. Feedback from PMP partner universities is that there is commonly progression from level 3 to level 4 higher apprenticeships. One partner in particular commented that Physics A-level does not tend to be seen amongst Higher and Degree apprenticeship candidates. Instead a broad range of qualifications and experience are taken into account and therefore can provide some flexibility for applicants.

Welsh Government have been implementing policy initiatives in order to increase the number of people in apprenticeships, with a target of 125,000 apprentices between 2021-2026. Data

⁵ Emsi Burning Glass (2021) *Physics in Demand: The labour market for physics skills in the UK and Ireland* Available: <https://www.iop.org/sites/default/files/2022-01/Physics-in-demand-labour-market-skills-uk-and-ireland.pdf>

⁶ Institute of Physics (2021) *Unlocking the potential of physics skills in the UK and Ireland*. Available: <https://www.iop.org/sites/default/files/2022-01/IOP-unlocking-the-potential-of-physics-skills.pdf>

from Welsh Government⁷ shows there is an imbalance with regards to gender at all levels. For example, based on 2021-2022 Q1 data we can see females made up thirty nine per cent of all apprenticeship programmes but less than six per cent of engineering apprenticeships and less than three per cent of construction apprenticeships. Other sectors where males outnumbered females were agriculture, manufacturing and transportation. In their review of the Engineering sector in 2020, Qualifications Wales reported that *“more could be done, particularly by schools, to promote engineering and apprenticeships”* and that *“there is a need to encourage more women and girls to study engineering-related subjects and to work in the sector”*.⁸

A further relevant policy area is the Welsh Government’s Plan for Employability and Skills⁹. The most relevant priority from this plan is in relation to supporting young people in realising their potential. There are number of milestones identified to be achieved by 2050, including the proportion qualified to level 3 or higher and the proportion of 16 to 24 year olds in education, employment or training. In these aspects, Wales have tended to be below the UK averages (Bell, Bristow and Martin 2017) and there is a broad variation at a local level across Wales¹⁰. Another important stream of policy relates to post-compulsory education and training (PCET) in Wales. Welsh Government have identified action is required due to a number of issues, including *“lack of coherent learning pathways and educational opportunities and inadequate employment opportunities”*¹¹.

Key findings

Awareness of post-16 routes into physics-related careers

Amongst secondary school learners and their families there was a lack of awareness of alternative routes into a physics-related career, especially routes which include Further Education. There was a preference for learners to take a route involving A-levels: *“I want to do A-levels because my parents say that is something good, so I'm just going to trust them”* (Secondary school learner).

⁷ Welsh Government (2022a) *Apprenticeship learning programmes started: August to October 2021 (provisional)* Available: <https://gov.wales/apprenticeship-learning-programmes-started-august-october-2021-provisional>

⁸ Qualifications Wales (2020) *The Importance of Engineering: Sector Review of Qualifications and the Qualifications System in Engineering, Advanced Manufacturing and Energy*. Available: <https://www.qualificationswales.org/media/6722/the-importance-of-engineering-oct-2020.pdf>

⁹ Welsh Government (2022b) *Stronger, fairer, greener Wales: a plan for employability and skills* Available: <https://gov.wales/stronger-fairer-greener-wales-plan-employability-and-skills>

¹⁰ Welsh Government (2022c) *Technical Annex: A Plan for Employability and Skills*. Available: <https://gov.wales/sites/default/files/publications/2022-05/technical-annex-stronger-fairer-greener-wales0.pdf>

¹¹ Welsh Government (2020) *Post-compulsory education and training (PCET). Principles for change. Supporting the PCET strategic vision* Available: <https://gov.wales/sites/default/files/publications/2020-11/principles-for-change-post-compulsory-education-and-training.pdf>

Further education students felt that the advice provided to them at secondary school with regards to further study was weighted towards them staying in secondary education: *“They didn’t tell us much about college”* and *“They would have rather we stayed on in school”* (Further education student). This extended to *“not telling us about how you can get to university through college”* (Further education student).

Career intentions

The groups discussed the reasons behind why they enjoyed some subjects over others. These included how they felt about the teacher, *“If you’ve got a brilliant teacher, then you’d be more interested in the subject”* (Learner, focus group), and being curious about the subject. Chemistry was given as an example of something where they want to *“know how and why something works the way it does”* (Learner, focus group). In terms of attitudes towards physics and science, there are some lingering impacts from the COVID-19 pandemic which are resulting in negative impressions of physics. Due to limits to practical work, some learners have not had much opportunity to undertake experimental activities to support their learning. Instead, they have been working through written booklets which has become *“monotonous”* (Learner, focus group).

Family influence and personal interests were strong factors when it came to the career interests of secondary school learners and the further education students. For those who were considering or undertaking apprenticeships, being able to combine study and work in order to ensure they didn’t have any debt was a key motivator. The further education students also cited work experience playing a role in helping them to identify what they wanted to do.

Careers advice and guidance

Secondary school learners do their own independent research online using information found via Google. Learners were aware of using resources from Careers Wales but this was normally following a talk, guidance from a careers advisor or an event in school. Family influence arose again when learners talked about where they sought advice. Overall, learners were keen to *“have as much advice as possible”* from a range of different sources in order for it to be more *“reliable”*. There were very mixed experiences in relation to careers advice and guidance reported by the further education students. Some were given clear guidance from their school-based advisor, another felt frustrated as their advisor kept suggesting alternatives that were nothing to do with engineering. For some of the group, they relied on the advice and guidance from their subject teachers. For others, their friends or family worked in engineering.

With regards to apprenticeships, there was an observation by one stakeholder that businesses were much keener to talk about these routes compared with schools. In schools there tends

to be a perception that work-based learning is not as prestigious as a university route. Teachers themselves have been an academic route, so unless they engage with professional learning activities in relation to careers they are less likely to be aware of options for their learners. In addition, parents have a similar attitude towards a university route and see that as a clear measure of success. Indeed, this issue is explicitly acknowledged by Welsh Government (2020) as part of their strategic vision for post-compulsory education and training: *“We must work towards true equality of esteem across all forms of post-compulsory education and training, and a gradual dismantling of traditional hierarchies between learners, providers and sectors”*.

Conclusion

Mentoring is effective when targeted at a particular group, whilst focussed on addressing a particular issue. Based on the rationale and the key findings, there is the clear opportunity for the project to contribute to meeting a wide range of policy targets in relation to education, employability and skills. There is an identified long-term skills gap in Wales, especially in relation to technical and higher level skills. There has been a growth in physics-related jobs and these can be found across a range of sectors in the labour market. It is expected that with the continued developments in technology and digitisation, current roles may disappear and new roles emerge, especially in response to the move to Carbon net zero. There is a call for a long-term strategic response to help close the skills gaps.

There is the potential for the Physics Mentoring Project to focus on the physics-related skills required by roles and this includes a significant number of routes which do not require a degree level qualification. There is the potential to provide more explicit guidance and descriptions of physics-related routes. Having a physics qualification provides the benefit of the combination of transferable skills along with physics-specific skills and knowledge, many of which will be crucial to emerging roles.

There is a lack of awareness of the alternative routes into physics-related careers amongst learners, parents and teachers and in terms of attitudes, there is a preference for learners to follow a path involving A-levels, with vocational courses continuing to be seen as less prestigious. There is a particular gender gap found in physics-related apprenticeships. The challenges relate towards attitudes and intentions around physics careers, and these are issues which are already being successfully addressed within the Physics Mentoring Project. In particular, the Physics Mentoring Project can act as a bridge or link between schools and colleges, the university sector, employers and other stakeholders such as Careers Wales and the IOP.

About the author

Ondata Research collaborates with clients to help them understand project impact, whilst also providing mentoring and support through the phases of project development and delivery.

Laura Thomas

Laura has extensive experience with a range of education projects across formal and informal education. In addition to evaluation she is experienced with project and resource development, delivery and training for a variety of organisations such as schools, science centres, museums, education charities, universities and professional bodies. She is undertaking PhD research relating to professional development of teachers after having completed an MRes in Educational Research with the University of Stirling.

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