

Supporting physics graduates' outcomes through the lens of work mobility behaviour, personal resilience and career readiness

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Acknowledgements

The authors would like to acknowledge the contributions of all the staff who are central to the delivery of the [White Rose Industrial Physics Academy \(WRIPA\)](#).

Background context

The Industrial Strategy, the current government's plan for the future of UK productivity, articulates the ambition to position the UK as the world's most innovative economy, requiring a flow of "high-quality graduates" to support innovation and regional economic growth (Department for Business, Innovation and Skills, 2019). No regional economy will grow if it does not attract people to work in it, or provide its existing population with the means to prosper. Such ambition is tempered by the reality that regional productivity in the UK has become highly unbalanced as the economy continues to shift towards service-centric growth in the larger urban centres (Selfin et al, 2020). This economic reality matters to a large number of university students, including physicists who seek skilled employment in their home domiciled region (Higher Education Statistics Agency Open Data, nd). This is a concern given the persistent and uneven regional productivity, the variability of labour markets across the country and constraints upon work mobility for some students (Zymek and Jones, 2020).

Project Context

Analysis of the graduate work mobility patterns of all UK students shows that the White Rose Industrial Physics Academy (WRIPA) universities of Leeds, Sheffield and York are the three 'top ranked' institutions in terms of retaining graduates in the region; in each case more than 30% of students who move from their domiciled region to study at these universities stay there to work. It is also noticeable that these institutions also facilitate a significant proportion of net migration to London (around 20% of students studying at these institutions). However, the majority of the remaining 50% of students return to their domiciled region to work. This is especially true of students domiciled in the north (east and west) of England and suggests that many students have a preference for location, dubbed 'emotional geography', based on close social networks, influence of family or proximity to urban conurbations (Miller and Donlan, 2014). The importance that students give to 'emotional geography' affects the kinds of jobs they can get after graduation (D'Silva and Pugh, 2020). This is crucial when considering graduate outcomes as the economy of the south of England significantly outperforms that of the north of England (Teow and Reilly, 2019).

Approach

Within the Yorkshire, Humberside and East Midlands (YH+EM) economic region sits the White Rose Industrial Physics Academy (WRIPA) (Hirst, 2019). Inaugurated in 2014 and supported by Hefce Catalyst funding, WRIPA is a 10-year collaboration between business and the university physics departments of Hull, Leeds, Nottingham, Sheffield and York. WRIPA's mission is to provide physics students with the opportunity to gain skills, knowledge and work experience that will better prepare them for graduate-level technical employment, irrespective of where they choose to work. This ambition is delivered through physics-contextualised activities based on curriculum development, careers support and the organisation of employer recruitment events. More recently, WRIPA has been awarded funding from the Office for Students' Challenge Competition to improve links between physics departments and regional employers, develop inclusive modes of work-based learning and support physics students to be more work mobile.

The technical versatility and breadth of skills of physicists are pivotal for driving growth in strategically important industries, including those in the YH+EM region (Institute of Physics, 2017); Department for Business, Innovation and Skills, 2017). However, there are significant challenges in connecting physics students to highly skilled (regional) employment opportunities that can be characterised in the following way:

- + physics students connect poorly with central careers services
- + physics students tend not to look broadly outside of academia when looking for a career
- + a high proportion of high value and technical employment in the region is through small and medium-sized enterprises (SMEs)
- + physics students are often unaware of the regional employment opportunities that are available
- + physics students disproportionately engage with large companies via institutional recruitment fairs and are not aware of the opportunities offered by SMEs.

The factors highlighted above give rise to three core challenges that WRIPA has identified and often preclude physics students from gaining undergraduate work-based learning experience or graduate-level work. These core challenges are: firstly, work mobility (ie emotional geography) – physics students prioritise 'place' or geographic location over 'work' when seeking post-study employment. Secondly, students' 'invisible barriers' (eg imposter syndrome, fear of failure) to non-academic attainment precludes them from applying for work-based learning opportunities or graduate roles. Thirdly, students self-select out of institutional recruitment fairs that they consider 'prestigious' or 'self-marketing' activities.

Outcomes, next steps and question:

To address these challenges, WRIPA has implemented the following activities highlighted below. WRIPA aims to support all undergraduate physics students to have the opportunity of gaining work experience and to apply their technical knowledge and skills in a professional context. This approach will enhance the career prospects of all physics students and allow them to realise their potential, irrespective of where they choose to work.

Physics graduate work mobility: WRIPA has partnered with the Higher Education Statistics Agency (HESA) to understand UK graduate students' mobility and how work mobility affects students' career prospects. The dataset comprises 1.87m DLHE records for all graduating degree cohorts between 2011 to 2017. In analysing this dataset, the study will investigate: (a) how mobile (WRIPA) physics students are compared to other institutions and subjects and (b) what factors correlate graduate level employment with mobility (eg gender, education background, schooling). Our initial analysis of the data shows that local physics students tend to take local jobs and the data indicates that those students that are 'work immobile' have lower graduate prospects. The data suggests the higher education and labour markets are not 'liquid'. Typically, physics students prioritise 'place' or geographic location' over 'work' when seeking post-study employment. In an economic sense, WRIPA physics students are far from 'rational'.

Better connecting physics students to regional work opportunities: WRIPA surveyed approximately 300 physics students across the five partner universities to understand their interest and awareness of the regional job market. Their answers were stark:

76% of respondents answered Agree/Strongly Agree to the proposition:

"I am interested to take up employment in my local region."

82% of students answered "No" to the question:

"Do you know of employment opportunities for physics graduates in your local region?"

To date, WRIPA has directly supported more than 250 students to gain technical work experience through industrial placements, internships and undergraduate industrial projects. WRIPA now places an increasing emphasis on connecting our students to regional technical employers through a broad range of interventions – for example, via curriculum development. In the academic year 2019/2020 WRIPA ran 21 final-year industrial projects involving 63 students. The majority of these projects were sponsored by regional employers. Nottingham Physics has recently launched an MSc in Applications of Machine Learning in Science that is primarily focused on developing professional graduates aligned to the fast-growing regional financial technology (fintech) sector. WRIPA also organises an annual physics-specific recruitment fair that connects midlands and northern physics students to technical employers. Typically, the fair attracts 700-900 physics students and 40-45 regional and national employers.

Supporting physics students to apply for work opportunities – invisible barriers to non-academic attainment: by surveying current registered year-in-industry students we found that fear of failure and imposter syndrome are strong demotivating factors for physics students applying for work-based learning or graduate opportunities. In response WRIPA has partnered with the Institute of Physics (IOP) to develop an Introduction to Resilience and Wellbeing guide. Published in late 2020, the guide is available to all UK university physics students (a current population of approximately 16,000 students) and will form the basis of a series of undergraduate workshops focused on aspects of resilience to change.

Optimising digital engagement tools to enable students to virtually research and connect with employers: we have found, from a WRIPA student survey, that a significant subset of physics students do not engage well with large corporate recruitment strategies or institutional careers fairs, which are perceived as 'prestigious' or a 'self-marketing' activity. To address this WRIPA is currently redesigning its website to enhance physics student career readiness and digital connectivity with employers. For example, a pilot project is ongoing between the physics departments of Leeds and Liverpool to develop an interactive Physics Careers Exploration tool. This digital tool will enable students to match their career aspirations and role preferences to physics-relevant jobs and subsequently to compatible employer webpages or WRIPA physics alumni. Initial feedback from students was:

Respondent A:

"Loved it – it actually gave me my desired career as my result, so that's pretty cool."

Respondent B:

"Think it's a super good concept for people that aren't sure what to do with their degree."

Conclusion

Greater attention than ever is being placed on how universities enable their graduates to achieve their career goals. Employability activities through curricular and extracurricular activities are typically a key approach used by both physics departments and careers and employability services to develop important graduate attributes based on skills-centred approaches. However, this approach is predicated on students being highly work mobile with high psychological capital (eg resilience in the face of change) and an awareness of how to relate their degree programme to regional labour markets. WRIPA looks to address these challenges by organising regional work-based learning opportunities that are contextualised in mathematics and physics or supporting our physics students to become more work mobile ie by supporting physics students to develop both their psychological capital and their social capital by, for example, building professional network contacts. We argue that while a skills-based approach is critical for physics students' learning, it is nonetheless too narrow and does not fully capture the complexity of work-ready graduates or graduate work mobility behaviour.