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'There's no going back': The transformation of HE careers services using big data

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The capacity for UK Higher Education (HE) careers and employability services to collect and analyse career thinking and employability enhancing experience data – Careers Registration data - has provided unprecedented insight into levels of student career planning, (work) experience gained, and sectors of interest. This article draws on the research findings from the Careers Registration learning gain pilot project, to identify the ways in which careers and employability delivery has fundamentally changed since the introduction of Careers Registration, and considers the impact of big data for the future of HE careers and employability delivery.

Big data in a higher education context

The 'volume, variety and velocity' (Shacklock 2016, p. 2) with which we are generating data in higher education is increasing. Throughout a student lifecycle, universities collect vast amounts of 'static' and 'fluid' data (Shacklock, 2016, p. 2). Static data is collected at regular scheduled points. Examples of static data in HE include: student data (collected at registration, including socio-demographic information and course details); student loans data; the Destinations of Leavers of Higher Education Survey (DLHE), and the National Student Survey (NSS), which collect information on employment and outcomes of graduates six months after graduation, and opinions on course quality respectively. Other examples include graduation surveys, which capture students' career thinking and plans at the point of graduation, and the Employability Health Check (EHC). The EHC is a comprehensive questionnaire designed to help students find out how their employability skills are developing as they progress through their course, and identify areas to work on.

Learners are leaving behind a 'digital footprint' (Long & Siemens, 2011, p. 32), generating 'fluid' data through everyday digital interactions. Such data include swipe card data (swiping into lectures and/or events), logins to virtual learning environments (VLEs) (Shacklock, 2016), library checkouts, and careers service engagement data, (e.g. appointments, careers fair attendance, employability award completion). HE institutions are in the midst of a 'data explosion' (Long & Siemens, 2011, p. 32). Data is no longer a by-product of HE activities, instead data has a central role in HE decision making. The use of technology to capture, process, and analyse information to enable informed decision-making provides value and meaning to big data (Daniel, 2017). Data and analytics help to reform HE activities, to assist educators to improve teaching and learning, and to motivate and encourage students by providing them with information relating to their own performance in relation to their peers, or progress towards personal goals (Long & Siemens, 2011).

In what ways might big data and analytics enable us to track and support students to develop their employability during their time in higher education? The three most important predictors of graduates moving into professional or managerial roles three years after graduation are having a plan; having done some research; having a targeted approach to job applications; and having undertaken unpaid work experience (Shury, Vivian, Turner & Downing, 2017). Big data and technology-based approaches enable universities to identify these predictors and their

prevalence much earlier in the student lifecycle, which can support employability outcomes of current students (Shury et al, 2017).

The increase in tuition fees and the introduction of the Teaching Excellence and Student Outcomes Framework (TEF) by UK Government in 2016, has placed HE institutions under additional pressure to demonstrate how well HE institutions ensure excellent outcomes for their students in terms of graduate level employment or further study (BIS, 2016; Winter, 2018). Many UK HE careers services are taking a data informed approach to decision making and improving careers and employability delivery by utilising relevant datasets (Shah & Welch, 2018; Riding & Crowe, 2018). Sources of data include DLHE data, Careers Service Management Systems (CSMS) data (such as TargetConnect, Careerhub and Abintegro), student records data, careers service engagement data, and Careers Registration data. Leveraging these datasets allows university careers and employability services to meet internal and external demands for insight into student journeys, progression and outcomes.

Careers Registration

The Careers Registration methodology, introduced at the University of Leeds in 2012 (Gilworth & Thambar, 2013), consists of asking students to self-report their subjective state of career readiness and to record objective actions in the form of a range of employability-enhancing activities such as undertaking an internship, completing an employability award, or undertaking part time work related to career plans. This includes both cognitive and behavioural development and is based on concepts such as vocational maturity (Super & Kidd, 1979), career success (Ng et al, 2005), and career adaptability (Savickas, 1997; Bimrose & Brown, 2015). The questions are embedded in the enrolment questionnaire completed by every student at the start of each year of study. This method of collecting data captures a small amount of cognitive and behavioural information on virtually every student within an institution. Collecting data on all students as opposed to surveying only the engaged students enables a better and more representative understanding of student needs. Careers Registration can therefore be useful in identifying the differential career development of various student groups.

The uptake of Careers Registration across the UK HE sector is widespread, with 62 UK HEIs implementing the methodology at November 2017, according to a survey of 186 UK HE careers professionals. Careers Registration is an example of how big data (a large scale, linkable, and longitudinally trackable data set) can inform decision-making and support evidence-based practice in a higher education careers and employability setting.

Figure 1: Career thinking question

What stage are you at in your career planning? Please choose from the options below, the response which most closely related to your current position.

Statement	Category
I am not ready to start thinking about my career yet	*Decide*
I have no career ideas yet but want to start thinking	*Decide*
I have some ideas about my career and I am ready to start planning	*Decide*
I have a career in mind and intend to gain relevant work experience	*Plan*
I know what I want to do but not sure how to get there	*Plan*
I want to spend a year gaining experience	*Plan*
I am ready to apply for graduate level/professional opportunities	*Compete*
I am ready to apply for further study	*Compete*
I have been applying for opportunities and so far I have not been successful	*Compete*
I have a job, further study or my own business plan confirmed	*Sorted*

Career readiness learning gain

The RAND review (McGrath, Hoareau, Harte, Frearson & Manville, 2015) defined learning gain as the 'distance travelled', or the 'difference between the skills, competencies, content knowledge and personal development demonstrated by students at two points in time' (McGrath et al, 2015, p. xi). 'Work-readiness' was a key area of interest in the RAND review of learning gain in the UK, and Careers Registration was identified as a potential measure of career readiness learning gain (Mcgrath et.al, 2015). In 2015 a consortium of 15 UK universities secured funding for a three-year project funded by the Higher Education Funding Council for England (HEFCE) to investigate Careers Registration as a potential measure of career readiness learning gain. For the purposes of the research, employability is defined as students' capacity to make well-informed, realistic plans for their future career and their ability to acquire the resources that enable them to execute these plans and successfully manage their career development in a changing world.

Careers Registration learning gain pilot project

The Careers Registration learning gain pilot project concluded in October 2018. The primary aim of this research was to assess whether Careers Registration can allow us to:

- Track learning gain (distance travelled) in relation to career readiness and employability of students during their time in higher education
- Predict employment outcomes for graduates
- Investigate the extent to which students are engaged in activities that enhance their employability
- Evaluate the effectiveness of employability strategies and interventions
- Investigate practical issues related to the implementation of Careers Registration within institutions
- Understand the extent to which the data it provides could inform institutional strategies for careers and employability support.

Research methodology

Fifteen partner institutions implemented Careers Registration at different points over the three-year project. Institutions utilised the two core Careers Registration questions (career readiness, and employability enhancing experience) along with additional questions on sectors of interest, future plans, and enterprise. The statements of the career readiness

Figure 2: Choose ONE or MORE statements from the following regarding employability enhancing experience you have undertaken in the last 12 months:

Work experience	Careers engagement	Mentoring	Pre course experience	Skills awards/ competitions	Volunteering/ positions of responsibility
Institutionally sourced: a placement year during my degree	**I have attended a departmental careers event**	**I have been a mentor**	**Full time work prior to my course (two years of less)**	**Institutional employability award**	**Committee member of a society or club**
Self sourced: holiday job unpaid internship paid internship part time work alongside my studies related/not to my career plans Self employed/ running my own business	**I have attended a one to one careers appointment**	**I have been a mentee**	**Full time work prior to my course (more than two years)**	**I am undertaking the Higher Education Achievement report (HEAR)**	**Volunteering in my local community**

question were categorised into four key phases of career readiness: *Decide, Plan, Compete* and *Sorted*. Responses to the employability enhancing experience question were analysed under a specially devised framework (Figure 2), where institutions included unique options pertaining to their student populations. The research applied the Gilworth (2017) definition of employability as 'the capability to make well informed, realistic plans for the future and to be able to execute these as a changing world' (Gilworth, 2017).

The research captured the career readiness of 308,000 unique students cross-sectionally (one response to the survey during any of the three years of the project), and 118,378 students longitudinally (responding to the survey year on year). To develop a connected picture of students' career thinking and experience in their own personal context, Careers Registration data was linked with other types of student data. These data included student characteristics, DLHE data, graduation surveys, careers service engagement data, and the EHC at one institution. Careers Registration contains its own entry measure as students complete registration questionnaires at the start of their university journey. This allowed the measurement of change in careers thinking from entry to the start of the final year for undergraduate students (career thinking movement). Response ratios (proportions of student selecting statements from each of the categories year on year) and *Compete* category growth (increase in respondents selecting statements within the *Compete* category) were analysed.

Multinomial modelling of careers readiness statement selection (n=89,000 for academic year 2016/17) enabled understanding of the relationship between career thinking (the nominal dependent variable) and a variety of socio-demographic characteristics (independent variables) (Field, 2009). The model held *Decide* phase career thinking as the baseline, and controlled for the year of study. The initial model included nine variables: POLAR3[1] quintile, age (mature/ under 21), ethnicity, disability, fee status, gender, subject of study and career thinking phase (*Decide, Plan, Compete, Sorted*). Three project partners also completed multinomial modelling of career readiness and outcomes (DLHE) at an institutional level on data for a full three-year undergraduate student cycle.

Findings

Cross sectional analysis of this large and complex dataset showed that 46% of all students selected statements in the *Decide* category of career readiness when they responded to the questions in 2016/17, and 43% of final year undergraduates were still in the *Decide* phase at the beginning of their final year of study.

Career thinking movement

Analysis of career thinking movement showed more movement between penultimate and final year of full-time undergraduate programmes, whereas smaller changes in career readiness occur between years one and two of full-time undergraduate programmes. Of students responding in years one and two of their programme, 59% had no change in their career readiness. Of those that changed their career readiness, 23% selected a higher ranked statement and 18% selected a lower ranked statement. Of those students responding in years two and three of study, 61% selected the same career readiness statement. Here we see a marginally higher percentage (26%) of students selecting a higher ranked statement and 13% selecting a lower ranked statement.

Compete category career thinking

There was an observed increase of 18.28% in *Compete* category responses between years one and three of study (1.52% students in *Compete* phase in year one, compared to 19.8% *Compete* phase in year three of study. When broken down by mode of study and fee status, findings revealed higher growth in *Compete* career readiness for students with overseas fee status and undertaking full time study. Only small differences were observed between students with widening participation (WP) characteristics and the rest of the cohort.

1 The participation of local areas (POLAR) classification groups areas across the UK based on the proportion of the young population that participates in Higher Education. POLAR classifies local areas into five quintiles based on the proportion of 18 year olds who enter higher education aged 18 or 19 years old. Quintile one shows lowest rate of participation. Quintile five shows the highest rate of participation. https://www.officeforstudents.org.uk/data-and-analysis/polar-participation-of-local-areas/polar3/

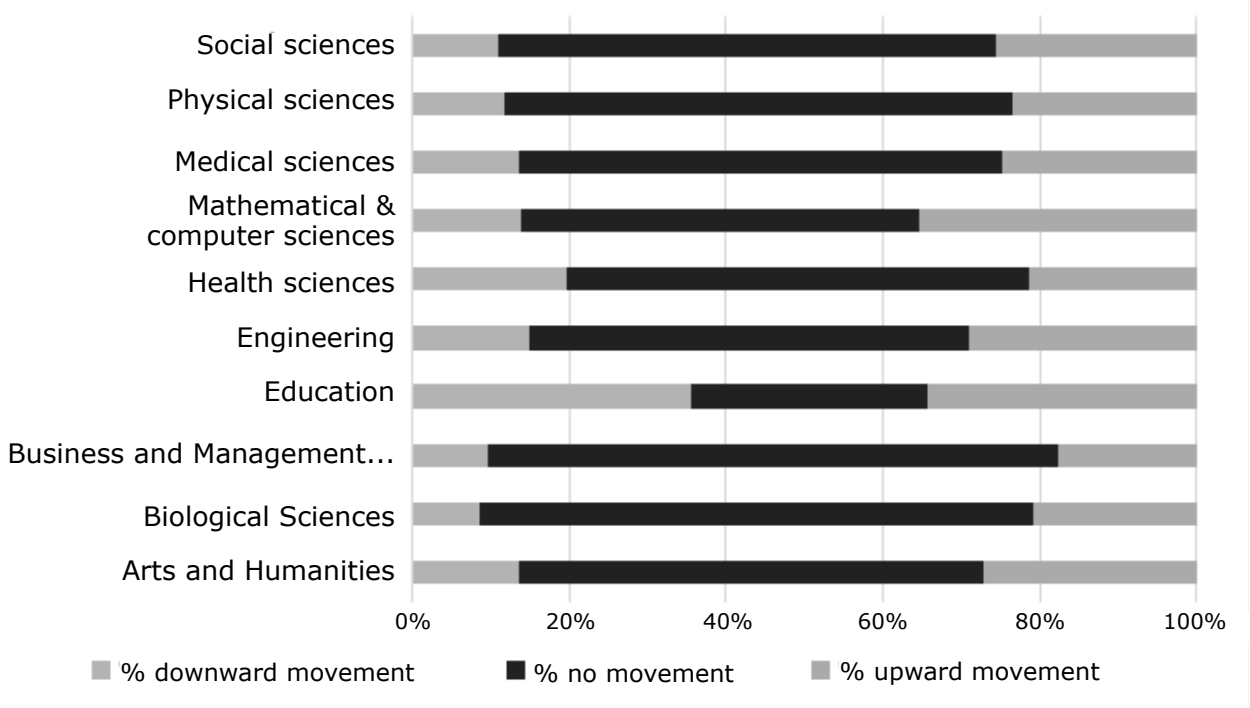

Chart 1: Y2 to Y3 tracking career thinking movement by subject of study

There were some large observed differences between subject areas. Overall non-science subjects had higher *Compete* category growth. Biological sciences had the smallest observed 'downward' shift of all subject areas (8%). Education is the only subject that showed an increased 'downward' movement in career readiness. This could be due to the wide variety of programmes included under Education subject codes, and this would benefit from further analysis at a more granular level.

Factors affecting career thinking

Four variables were significantly associated with career thinking at the 98% confidence level: POLAR3, age, ethnicity and fee status. Students from POLAR3 quintiles one and two (lowest participation neighbourhoods) were more likely to be in the *Decide* phase than *Compete* phase of career readiness at each year of study – though the effect size decreases with increasing years of study. Black and ethnic minority students were more likely to be in *Decide* phase of career readiness than white students. Young students were more likely to be in the *Decide* phase of career readiness than mature students. Home/EU students were more likely to be in the *Decide* phase than overseas students.

Career readiness and graduate outcomes

Institutional level modelling at three partner institutions found a significant correlation between career readiness and graduate outcomes. Final year students who are further along in their career planning (i.e. in the *Compete* phase) are somewhat more likely to be in employment after graduation and significantly more likely to be in a graduate role. A change in career readiness between the penultimate and final year of study has less impact on outcomes than the phase of career readiness reported at the start of the final year. The overall probability of finding any type of employment increases with the career readiness stages, and is slightly higher for undergraduates compared to postgraduates.

Analysis showed final year students who have no work experience are considerably less likely to be in employment after graduation and statistically less likely to be in a graduate role. Students who do a placement year as part of their undergraduate studies have an increased probability of finding graduate level employment. Female graduates were half as likely to be earning a higher salary (£30,000 or above) than their

male peers. Female graduates were also significantly more likely to be in the earlier phases of career readiness than their male peers.

How is Careers Registration data being used to develop professional practice?

Data is no longer a by-product of the day-to-day business of HE providers, it is a 'critical value layer' for driving strategic decision-making at an institutional, regional and sector level (Long & Siemens, 2011, p. 34). HE careers and employability services are drawing value and meaning to Careers Registration data by analysing and presenting this data for the purposes of 'holistic decision-making' (Long & Siemens, 2011, p. 36) through strategic and operational engagement with academic departments and senior managers. This includes drawing up partnership agreements; sharing subject specific data packs with academics to provide key employability information focusing on career readiness; informing institutional policy and decision making; and persuading employers of student interest in their sectors. Careers and employability services have also used the data to promote relevant events and provide support to students from at risk groups including students from WP backgrounds, and those with no work experience, or career plan, as identified as key to graduate success (Shury et al, 2017).

Careers Registration data is included in institutional key performance indicators and metrics. Access to quick, timely, accurate and connected data allows careers and employability services to engage responsively with their stakeholders (students, academics, employers, senior managers). Careers Registration has the potential to be a component of a standardised measure of learning gain in relation to student employability and is in widespread use as a local measure in the institutional context.

The ability of careers and employability services to visualise, contextualise and communicate the data with staff and students in a timely manner is key to supporting decision making in real time, and gives value to the data (Daniel, 2017), to help students engage with, and develop their own career readiness.

Limitations

Careers Registration is a self-reporting tool and is therefore potentially subject to self-reporting bias (Bryman, 2016). In particular, students near the start of their studies may have more limited or unrealistic awareness of their future options, preferences and their own capabilities. This may lead them to over-report their state of career readiness. For example, students on biomedical sciences programmes may start their studies with the expectation that this will lead to them studying medicine in the future and so report themselves as having a career plan in mind. As they progress in their studies, they may gain a better understanding of how likely this really is or may become aware of other options available to them. This may cause them to select lower ranked statements on subsequent surveys. They will appear to go 'downwards' on the scale but their career thinking has become more realistic. The methodology uses a compact data collection tool, which is simple to implement within the student registration process. Whilst this means we capture data on the majority of the student populations, improving the reliability of our findings, we are limited on the level of detail we can collect. The development of a standardisation framework (fig 2) to account for institutional differences in methodology, notably the wording of questions and response options, makes it possible to analyse Careers Registration data at a sector level. This could allow for regional, mission group and subject level benchmarking on a national scale.

Conclusions

There is no going back for careers and employability services in terms of big data and analytics. Careers Registration data provides unprecedented insight into what students are doing to plan their career, and the experiences they are gaining to support their employability. The research findings support and build upon the findings of previous research into graduate outcomes (Shury et al, 2017). The findings demonstrate that being further along in your career thinking, and undertaking employability enhancing experience such as internships or holding a position in a student club or society are associated with graduate level outcomes. The knowledge that just under half

of all students are still in the *Decide* phase of career thinking at the start of their final year of study enables HE providers to plan timely interventions and streamline resource allocation to support students at pivotal points in their student journey. This can help students to progress their career planning, gain helpful experience and review their own progress.

Access to this data is both an opportunity and a challenge. Careers and employability services are not traditionally set up to deal with this kind of large-scale data, and there is a need to build greater data capacity within services. Improvements to data capacity could include more intuitive CSMS and dashboards. Subsequently there is a need to develop staff data capabilities and confidence. Manipulating, visualising and explaining Careers Registration data are central to ensuring that the value of such large-scale data sets to careers and employability services are shared with students and staff to enable targeted resourcing and support to help learners develop their employability and plan their future.

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