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Published online: 20 Jan 2023.

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Academic career progression from early career researcher to professor: what can we learn from job ads

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ABSTRACT

Academic careers are complex, diverse, and increasingly competitive. Building on previous research on selection criteria for admission to early research careers, this research expands the analytical focus to examine attributes requested in job ads at each stage of an academic career. Our data, extracted from a European job platform, draws on over 40 different disciplines, 3000 universities, and 60 countries. We developed a taxonomy from the selection criteria data and analysed 40,819 advertisements for all stages combined and posted in 2016-2021. We analysed the most prevalent and salient attributes listed in academic job ads to determine the most important attributes in the five most represented countries and disciplines, and changes by stage and across the academic career lifespan. We find that degree and achievements play a principal role in academic recruitment at each stage of career, mobility is key to progression in senior roles, teaching gains importance towards professoriate, and senior academics need to be equipped with skills and/or experience in fundraising, curriculum, and outreach. The insights inform policy and practice for institutional researcher development, capabilities framework development, human resources, and academic recruitment, and provide guidance for academic career planning and development.

Introduction

Academic careers are complex, subject to constant change, and increasingly resemble professional careers (Harley et al. 2004), shown in the rise of market-sensitivity, regulation, and linked to managerialism in higher education (Lee and Kuzhabekova 2018; Ferlie, Musselin, and Andresani 2008; Kaulisch and Enders 2005). Baruch and Hall (2004, 241) go so far to say that 'careers in academe have moved toward more of a corporate direction, as universities have become more customer focused and business driven'. However, the context of the academic career as a knowledge-based occupation is unique. Much of a career is shaped by the broader higher education system and there are substantial variations across countries and disciplines (The League of European Research Universities (LERU) (n.d.); Ferlie, Musselin, and Andresani 2008; Lee and Kuzhabekova 2018). The higher education sector is increasingly globalised, demanding greater mobility for academics and improved methods for international recognition of qualifications and experience to facilitate

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greater mobility of the professoriate. At the same time, higher education is marked by job insecurity and casualisation (Kraimer et al. 2019).

Such factors significantly shape how academics progress across the academic four-stage career trajectory, from PhD to professoriate, and importantly their ability to meet academic job requirements. Insecure employment has a largely negative impact on academics' research careers (Broadbent and Strachan 2016). Insecure employment in academia has effects on the ability to publish, develop an independent research profile, and form networks and collaborative connections (Broadbent and Strachan 2016; Kraimer et al. 2019). Research on doctoral and postdoctoral positions (Zubieta 2009) suggests that international mobility is now the key to academic career progression at the early career level. International faculty mobility also boosts networking and knowledge transfer (Lee and Kuzhabekova 2018). However, geographical mobility has its costs and not every academic benefits from it (Tzanakou 2021). Interdisciplinary mobility is common amongst academics at all career stages, but cross-disciplinary mobility is rare (Baruch 2013). The latter suggests that academics stay loyal to their discipline. Above all, the quality and quantity of research are the main currency in moving up the academic career ladder.

While the above illustrates the complexity of academic careers overall there is a notable lack of understanding of what is required at each stage of an academic career, so 'the factors contributing to a successful academic career are far from clear' (Kindsiko and Baruch 2019, 122). We also know little about national and disciplinary differences. Only a few studies examine stage-by-stage progression and requirements. For instance, Baruch (2013) states that career progression to higher levels usually involves moves from scholarly roles to managerial or service roles. Research on country-level analysis, however, suggests that Baruch's description of academic career progression might be too simplistic. LERU shows that UK professors are engaged in more research, while German professors still do a large amount of teaching and administration. Ferlie, Musselin, and Andresani (2008) point out that especially in Europe there exist complex relationships between the national state government and the academic profession, demonstrated in the state's input regarding the shape and recruitment of academics, e. g. professor appointments in Germany are often subject to state decisions. Frølich et al.'s (2004) report on Northern Europe demonstrates country differences in academic career structures, research and teaching distribution across academic levels, and academic job requirements overall.

This complexity is of concern because not only does it make planning and managing progression for those pursuing knowledge work opaque and difficult, but it also removes transparency of expectations and standard requirements for those who want to move up the academic ranking or seek international or interdisciplinary mobility. Further, research on academic progression is dominated by small-scale qualitative studies describing academics' lived experiences. While this approach undoubtedly adds value, there is a glaring lack of empirical large-scale research to inform academic career progression representing all career stages. Zacher et al.'s (2019) comprehensive review of dominant themes in academic career literature showed that research overemphasises the early career stage and underrepresents the mid- and late-career stages. However, many academics today will not experience the same opportunities and possibilities to advance their careers as did academics a generation ago due to casualisation and precarity in academia, so there is a need to focus on the later career stages (Austin 2002). As most people pursuing research training wish to stay in academia (Mantai and Marrone 2022; Etmanski 2019), understanding academic career development and progression is critical to adequately support this knowledge workforce.

To determine what is required at each academic career stage, we analysed academic job advertisements (job ads, here forth), the variance by country and discipline, and changes over time. Stimulated by Zacher et al.'s (2019) call for longitudinal research on academic career progression, research that adopts a lifespan perspective, and theoretical contributions that consider national and disciplinary settings and temporal changes, we ask: what skills and qualifications (in short: selection attributes) matter most at each stage of an academic career from PhD to (full) professor. Our contribution focuses on uncovering selection attributes most wanted at each stage of an academic

career. Importantly, we contribute empirical evidence to characterise academic career stages as hitherto defined by the theory of career lifespan (Super 1980), that considers national and disciplinary variance and change over time. As competition in academia grows, planning and preparing for academic careers improves the prospect of achieving success (Sutherland 2018; Kindsiko and Baruch 2019; Kraimer et al. 2019). We discuss theoretical and practical implications, as well as offering directions for future research. Specifically, this paper offers a taxonomy to describe academic job requirements that can be used by academics for self-assessment and professional training, and by universities to inform their academic capabilities framework, promotion and performance criteria and importantly ongoing staff development.

Academic career progression in practice and theory

We conceptualise the academic career as a sequence of academic work experiences and roles that evolve across a lifespan. Super's (1980) career theory proposes that careers are dynamic and can be divided into several periods. Based on Super's (1980) developmental dimension of the career lifespan theory, Thorn (2009, 455–456) defines 'four career stages as exploration (commencing prior to the career), establishment (a period of becoming employed and finding a niche), maintenance (a period where the career continues but progress slows)' and decline [later changed to disengagement] (where productivity and contributions decreased). The career lifespan theory is a widely accepted career development theory and often applied to academic careers (Arthur, Hall, and Lawrence 1989; Zacher et al. 2019; Lent and Brown 2013). Academic positions are commonly structured in a four-tier system ranging from doctoral studies, postdoc and junior positions, lower-level senior to higher-level senior positions. However, the boundaries between tiers are drawn differently by each country (Frølich et al. 2018; Fumasoli, Goastellec, and Kehm 2015).

Previous studies have not evenly looked at academic career development phases. Much research focuses on early career academics and doctoral education (e.g. Zacher et al. 2019; Kindsiko and Baruch 2019), yet later academic stages are often ignored (Zacher et al. 2019; Debowski 2022). Debowski's 2022 reflective account on the academic requirements at different stages presents early career academics as novices moving to become independent and confident scholars, mid-career academics as taking up more formal governance and leadership roles associated with research, teaching and service, and senior academics as leaders in their field with strong presence and providing guidance for junior staff and professional communities.

At the centre of the academic career, the 'publish or perish' narrative emphasises the critical importance of publication output (Dany, Louvel, and Valette 2011). Research is widely recognised as the key to academic success, while teaching assumes a secondary position (Matthews, Lodge, and Bosanquet 2014; Kaulisch and Enders 2005). The initial stages of an academic career (i.e. PhD) require little to no teaching or ability to gain external funding (Austin 2002), while later stages of the academic career are often portrayed as professors freeing themselves from teaching to concentrate on research (Angervall, Gustafsson, and Silfver 2018). The responsibilities of junior staff in some institutions differ, too. In Finland and Portugal, early career academics spend more time on teaching than senior staff (Larsen 2018). In Norway, the opposite applies, junior academics spend most time on research (Teichler, Arimoto, and Cummings 2013). In Germany, junior staff are to a lesser extent involved in teaching than professors but spend more time on service functions (Teichler, Arimoto, and Cummings 2013).

The narrow focus of academic career research can also be observed when examining nationality and discipline. Studies often explore one country (e.g. Dany, Louvel, and Valette 2011; Ortlieb and Weiss 2018) and in rare cases compare two (e.g. Harley et al. 2004) and more national contexts. However, mobility is important in academic careers and the cross-national perspective is missing (Zacher et al. 2019).

With regards to disciplines, studies in medical sciences dominate (Zacher et al. 2019) and comparative studies are few (e.g. Duberley, Cohen, and Mallon 2006; Harley et al. 2004; Dany, Louvel,

and Valette 2011). This limits the generalizability of academic progression research. Disciplines have distinct cultural characteristics with regards to research, external engagement and patterns of learning and teaching, and should not be overlooked (Becher 1994).

Like professional careers, academic careers evolve over time (Baruch and Hall 2004; Teichler et al. 2013; Debowski 2022) and are increasingly reconfigured by national governments, higher education reforms, and research evaluation strategies (Musselin 2013). This is evident in countries such as Germany and France, for instance, (Ferlie, Musselin, and Andresani 2008). Teicher et al. (2013) describe the academic profession as extraordinarily dynamic and identify a growing expectation in academic work and hence, it is conceivable that over time, such expectations would also be reflected in academic job ads.

Given the elevated expectations placed on academics, it is understandable that much focus is dedicated to academic development and progression. Baruch states (2013, 200) that 'academic work takes place in a knowledge-intense environment, with high dependence on human capital', and this dictates that universities develop people so they can develop their potential and the knowledge economy. The academic career no longer moves in one direction and not only upwards within a single organisation, making academic careers boundaryless (Baruch 2013). Interestingly and noteworthy, literature on academic development focuses on teaching skill development rather than researcher development (Åkerlind 2005; Åkerlind 2008; Matthews, Lodge, and Bosanquet 2014) and post-PhD researcher development is up to the academic (Mantai 2017). So far, much research on academic development is based on academic's personal perspectives shaped by external (e.g. sector and institutional, economy and culture) and personal factors (e.g. values and behaviours) that drive continuous researcher development (Zacher et al. 2019). Academic career needs and drivers are less expressed in terms of skills or qualities demanded of academics, but more commonly in the form of outputs, impact, and publications (Mutanga and Kaisara 2021). The research reported in this study aims to improve our understanding of academic career demands with respect to career stage, country, and discipline.

Methodology

To find out what skills and attributes are sought in academic careers overall and at each career stage we first conducted a systematic collection of job data across 2016–2021 available on Euraxess. Euraxess is a European platform listing vacancies for academic positions from countries in Europe and elsewhere. Euraxess is backed by the European Union, member states and associated countries; it supports researcher mobility and career development, while enhancing scientific collaboration between Europe and the world. The fields in each advertisement state the general job description, benefits, and requirements (subdivided into skills or qualifications required and other requirements). They also include information on the university advertising the post, field of research, location, languages required and position status, together with other details, e.g. starting date. Euraxess divides its job ads in four stages:

R1 First Stage Researcher (up to the point of PhD): includes research assistant and PhD roles

R2 Recognised Researcher (PhD holders or equivalent who are not yet fully independent): includes post-doc, lecturer and senior lecturer roles

R3 Established Researcher (researchers who have developed a level of independence.): includes associate professor roles

R4 Leading Researcher (researchers leading their research area or field): includes full professor roles

This four-tier structure is based on the European Commission (2011) framework and is common in academic careers world-wide (Fumasoli, Goastellec, and Kehm 2015). We then developed a skill taxonomy for academic careers which builds on previous research (Mantai and Marrone 2022), where

we followed a data-derived approach to develop a taxonomy of attributes based on job selection criteria.

Collecting data from academic job ads

When harvesting data from Euraxess, we applied five inclusion criteria:

- Date published. Since Euraxess became popular for such ads in 2016, as judged by the number of academic positions advertised, data from 2016 to 2021 were included.
- Only universities were included. This means that research laboratories, public and private research institutions and corporations were excluded from the sample.
- Jobs with a singular researcher profile were included. Job ads seeking multiple researcher profiles were excluded.
- Only ads with Skills/Qualifications and Specific Requirements text. In Euraxess, each PhD ad is structured in several sections: we focus on the Skills/Qualification and Specific Requirements sections and merge these to create one unit of analysis per ad.

Of the total of 421,654 ads initially downloaded 40,819 met the inclusion criteria, as shown in Figure 1 below. Our analysis used the date posted (year), field of research, location, researcher profile, job status and type of contract. Over 60countries (including a small number of non-European
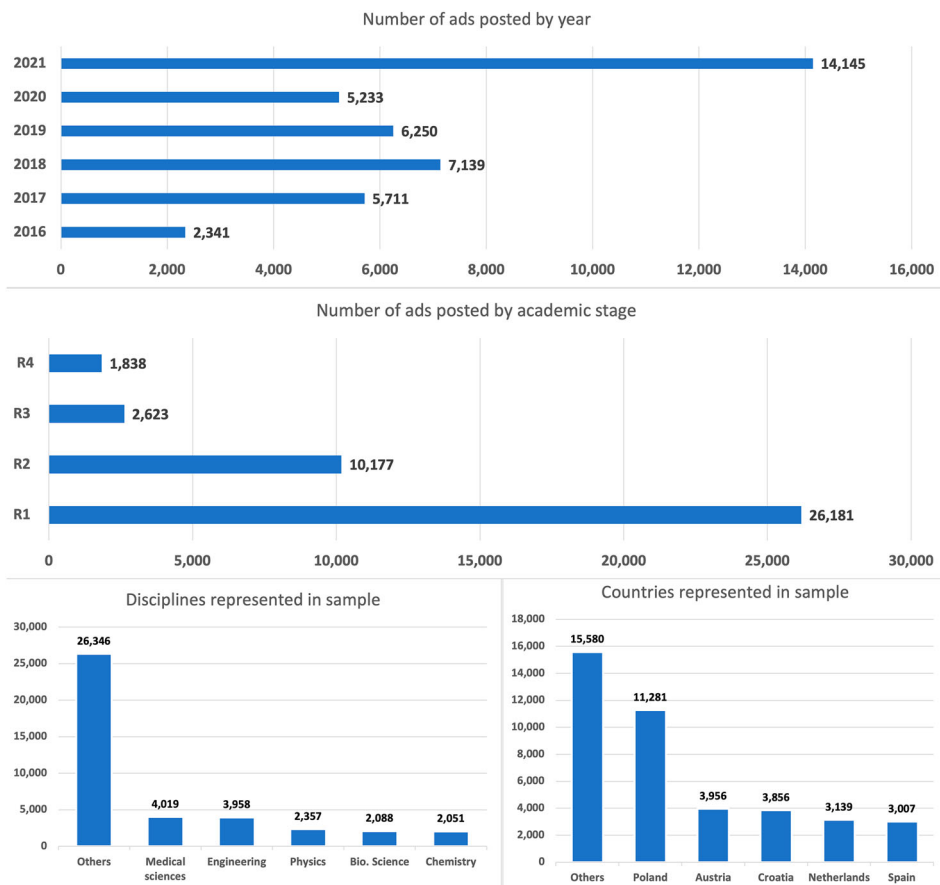

Figure 1. Sample characteristics.

countries) and over 40 disciplines are represented in our sample with Poland, Austria, Croatia, the Netherlands and Spain, and Medical sciences, Engineering, Physics, Biological sciences, and Chemistry posting most ads in 2016-2021. The top 100 higher education institutions that post most frequently on the Euraxess platform account for over 50% of all the job ads in our data sample. Appendix 1 shows the frequency of ads by university. Top-ranked universities posted 36% of all ads in our sample and medium-ranked universities were underrepresented (12%).

Developing a taxonomy and analysing academic career skills

We build on (Mantai and Marrone 2022) methodology which developed a data-derived taxonomy based on PhD admission criteria (equivalent to R1) to identify the attribute categories most prevalent in the job ad data. Dictionary-based entity extraction tools identified occurrences of pre-defined entities in job ad text and extracted features in unstructured text into pre-defined categories. We used a dictionary-based entity extraction tool which searches for occurrences of terms (either as full or partial matches) within ads, returning the categories which are present in the job ad (see Mantai and Marrone 2022). For more details on the development and use of extraction tools, the intricacies of developing skill taxonomies, and text mining in job ad data please refer to prior research by (Mantai and Marrone 2022).

To develop the skill taxonomy, we drew on the Eurodoc framework 'Transferable Skills for Early-Career Researchers' (here forth: the Eurodoc framework). The Eurodoc framework was developed by the European Council of Doctoral Candidates and Junior Researchers (Eurodoc) (2018). In an earlier publication (Mantai and Marrone 2022) we validated the Eurodoc skill taxonomy as a suitable mechanism to analyse academic jobs, and proposed an enhanced taxonomy derived from R1 data.

In this paper, we extend the taxonomy even further to suit all academic career stages R1–R4 with the intention to capture what data tells us and what was not yet listed in the Eurodoc taxonomy. We specifically added attributes found in R2–R4 job ads. To do this, we looked at the top 200 salient terms across all R stages ($n = 40,819$) and added to the taxonomy those attributes that were not yet included. Most of these were added from the later career stages R2–R4 data, as expected, e.g. attributes required for more senior academic positions like leadership, management, curriculum. Initially, we kept the 10 categories developed in (Mantai and Marrone 2022) and added new attributes to the taxonomy according to respective categories. In doing so one category was not present in this data, namely Career Development. This is expected as job ads do not normally list 'interview skills' or 'career planning' skills in their selection criteria, although recruiters might state that a candidate is expected to engage in further development on the job. Hence, we disregard this category in the analysis and did not include it in the final taxonomy. The Enterprise category that did not feature strongly in R1 data (Mantai and Marrone 2022) was more dominant in R2–R4 data and hence, was included in the analysis of R1–R4 data. The 11 final admission attribute categories and the individual attributes within each are below (Table 1).

The full taxonomy applied to the job data uses all variations of the search terms e.g. organised and organised, team work and team-work and teamwork, as indicated by 'etc.' in the list of examples above. The complete taxonomy can be provided upon request from the authors, however, is omitted here for brevity reasons.

To analyse academic career skills and to ascertain the likelihood of an attribute and category being present in a job ad, logistic regressions (LR) were performed for each category as our outcome variable (i.e. category) is either present or not in a job ad. The reference category is 'not present.' The predictor variables are: (1) year of ad publication, (2) country of ad and (3) discipline of ad. A logistic regression analysis was conducted to understand the likelihood of a category being present in an ad, given the year of publication, discipline, and country. We considered year as a covariate (continuous variable), while discipline and country were considered factors (categorical variables).

Table 1. Skill taxonomy of academic skills.

Attribute category	Search terms
1. Research	monograph | journal article | manuscript | conference | publish | publication | reporting | statistic | data analysis | citation | etc.
2. Digital	data mining | big data | algorithm | artificial intelligence | autocad | java | linux | matlab | etc.
3. Communication	spoken | speak | oral | verbal | academic writing | social media | etc.
4. Interpersonal	partnership | cooperative | team |social ability | managerial | lead | etc.
5. Cognitive	creative | critical thinking | inventiveness | analysis skill | conceptual | problem solving | cognitive | etc.
6. Teaching and Supervision	teach | supervising | course | pedagogy | didactic |curriculum | keynote | etc.
7. Personal attributes	ambitious | enthusiastic | motivated | proactive | openminded | friendly | talented | hardworking | etc.
8. Degree and Achievements	award | certificate | reputation | PhD | Master | academic record | etc.
9. Previous work experience	placement | industrial experience | internship | professional experience | etc.
10. Mobility	driver's license | fieldwork | travel | international | abroad | IELTS | Croatian | English | etc.
11. Enterprise	enterprising | patent | invention | commercialisation | etc.

Results

We present our findings with two foci in mind, one that describes the academic career overall based on data analysis independent of stage, and another that describes stage-by-stage differences and based on analysis and comparison of R1 to R4 data. Both foci are intertwined in the analysis and inform each other in our discussion.

The sample characteristics are presented in Figure 1. We find that most jobs are advertised at R1 stage (84% of our sample) and noticeably less jobs at each other stage, e.g. only 5% are R4 positions. Also, year 2020 saw a large decrease in academic job ads that met the inclusion criteria, which might be explained by the COVID-19 pandemic. In 2021 the number of ads almost triple the 2020 count (e.g. top 10 represented universities in our sample posted 87% more ads in 2021 than in 2020), suggesting a recovery in the academic job market, at least in Europe.
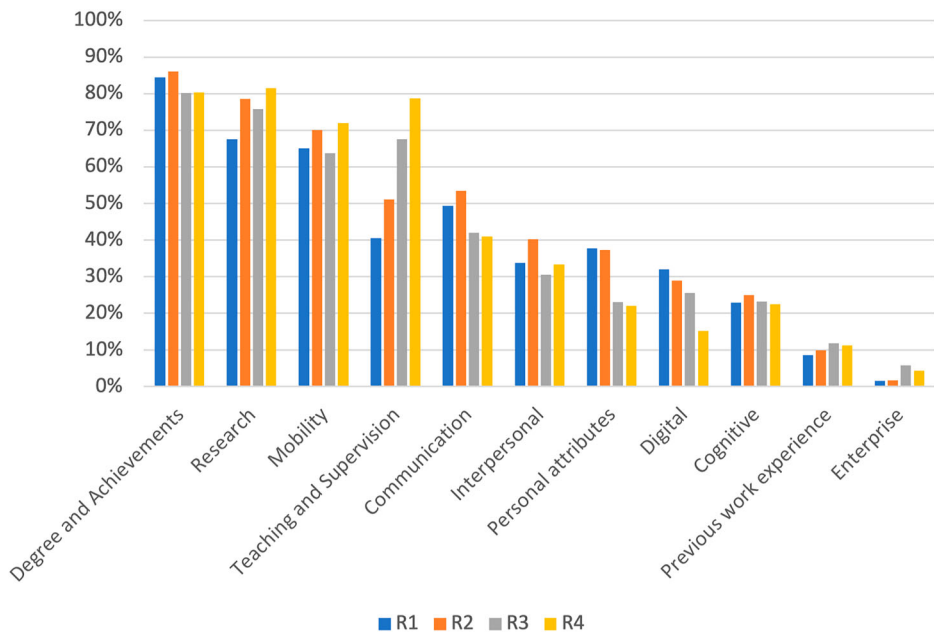

Figure 2. Attribute categories by R stage.

Regarding the attributes, Figure 2 shows the most frequently listed attribute categories by R stage in order of importance from highest (Degree and Achievements) to lowest (Enterprise), independent of country, discipline, or year. It is worth noting here, that Mobility comes before teaching as it features higher than Teaching and Supervision for R1–R2, but lower in R3–R4. We find that all 11 categories are present at each stage of an academic career and there appears to be no clear polarisation or division between groups of category attributes. Only professor-level jobs indicate a division between a group of highly sought-after attributes composed of Degree and Achievements, Research, Mobility and Teaching and Supervision, and a group comprised of the other six categories. Qualifications like degrees, achievements, certificates, diplomas, etc. dominate the selection criteria as the highest attribute category in demand in R1-R3 but give way to Research (publication record, etc.) at R4, where Research comes first.

Drilling down to attribute level (see Table 2), we gain a more granular picture of which particular selection criteria are most prevalent at each R stage of an academic career, independent of country, discipline and year of ad posting. Table 2 presents the top 10 featured attributes (as shorthand for selection criteria) per R stage. While requirements of specific qualifications are usually listed as the first item in most job ads, we see more variation and movement in the Top 2–10 attributes. For example, English, speaking and writing abilities, as well as communication skills are requested less as an academic career progresses. Communication is not even among the Top 10 in R3–R4. Research activity and publication record maintain their front positions and are continuously demanded across an academic career. Teaching skills and experience gain importance as they get more frequently listed over the academic career life span, placing second before research and after qualifications in R4 stage. A clear trend upwards from R1 to R4 is noticeable in the mobility-related attribute 'international/abroad/overseas', which collectively describes a requirement of having international connections, experience, and the need to travel.

We also find different requirements listed in R1–R2 when compared to R3–R4. While PhD candidates, post-docs, lecturers, and senior lecturers are expected to evidence academic writing skills and teamwork ability when applying for a job in R1–R2, other aspects gain importance in associate professor and professor level jobs, such as curriculum (including design and development skills, knowledge, and experience), fundraising, conferences, and unique to top 10 in R4, supervision. Croatian makes it into the top 10 because Croatia listed a majority of open R4 positions between 2016 and 2021.

Further we conducted a correspondence analysis to find out how remote the different R stages are from each other in terms of attribute categories requested at each stage. Dimension 1 accounted

Table 2. Top 10 attributes by R stage (percentage of ads containing this attribute).

First stage researcher (R1)	Recognised researcher (R2)	Established researcher (R3)	Leading researcher (R4)
award (84%)	award (86%)	award (80%)	award (80%)
english (49%)	research (60%)	research (60%)	teach|classes|tutorial|lecture (68%)
research (48%)	english (49%)	teach|classes|tutorial|lecture (58%)	research (63%)
spoken|speak|oral|verbal (37%)	publish|publication (48%)	publish|publication (49%)	publish|publication (55%)
publish|publication (27%)	spoken|speak|oral|verbal (40%)	spoken|speak|oral|verbal (34%)	international|overseas|abroad (37%)
teach|classes|tutorial|lecture (27%)	teach|classes|tutorial|lecture (39%)	english (30%)	spoken|speak|oral|verbal (33%)
academic writing|written|writing skill (25%)	team (31%)	international|overseas|abroad (29%)	english (26%)
team (25%)	international|overseas|abroad (28%)	conference (17%)	supervis (21%)
communicat (23%)	academic writing|written|writing skill (24%)	fundrais|fund rais|funding|funded|grants (17%)	croatian (20%)
international|overseas|abroad (17%)	communicat (24%)	curriculum (17%)	curriculum (20%)

for 90.2% of the variance, therefore only one dimension is displayed in Figure 3. Additionally, the Enterprise category was removed, because it was an outlier in this chart (being placed on the far-right end). To interpret this in a correspondence analysis, we look at the distance between attribute and R stage. The smaller the distance, the higher the association between the skill and the R stage, the greater the distance, the less significant the relationship. Looking at Figure 3, we see that Teaching and Supervision category is at the opposite end of Personal attributes and Digital, which suggests that such attributes are not commonly co-requested in the same job ad. This means we would only find one or the other listed in a job ad.

Focusing on the distance between R lines, this correspondence analysis suggests that R1 is closer to R2 in terms of job requirements. The academic career progression, at least in terms of selection criteria, sees the biggest jump, i.e. greatest difference in requested attributes, between R2 (equivalent to post-doc and lecturer-senior lecturer roles) and R3 (equivalent to associate professor), while the jump to R4 (equivalent to full professor) from R3 is similar to the jump from R1 to R2. The distances between R stages suggest clear shifts in skills and attributes.

Considering which attributes are closest to R stages, we find further relationships. R1 is strongly associated with Personal Attributes and Digital. At R2, Communication, Interpersonal, Degree and Achievements and Cognitive play a more significant role than in more senior roles. R3 and R4 particularly value Enterprise and Teaching and Supervision skills.

To understand the differences and changes between R stages across an academic career, we further look at the effects of discipline and country, as well as year of job ad posting. To do so we conduct logistic regressions for each attribute category considering variables of country, discipline, year of posting (refer to (Mantai and Marrone 2022), for further details on logistic regressions). This approach reveals more contextual and detailed insights for each attribute category and paints a more complex picture of academic career progression. Figure 4 presents an aggregated overview of the main findings. We limit our detailed analysis to five most represented countries and five most represented disciplines for illustration purposes and to ease legibility. The plus icon (+) signals a positive relationship and association, the minus (–) signals a negative relation or association, an empty cell shows no significant association. Detailed analysis of other countries and disciplines can be provided upon direct email request from the authors.

The country analysis (Figure 4) reveals that not all countries nor all the disciplines value attributes equally. Austria, the Netherlands, and Poland have diverse skill requirements as they highly value more than half of the attribute categories. Spain only shows a significant relationship with Digital and Previous Work Experience, categories that are most associated with earlier career stages.

In relation to the five most represented disciplines and which attributes they request more frequently, we find that the top disciplines are all located in STEM (Science, Technology, Engineering, and Mathematics) areas, and amongst them Biological Sciences request a larger number of attributes (i.e. five out of 11 attribute categories). The other disciplines emphasise one or two attribute categories.

Taking the temporal aspect into account shows how attribute categories gain or lose importance over time, that is which attributes are less or more requested year on year. We find that Digital, Teaching and Supervision, Degree & Achievements, Previous Work Experience and Mobility are

Figure 3. Correspondence analysis of attribute categories and R stages.

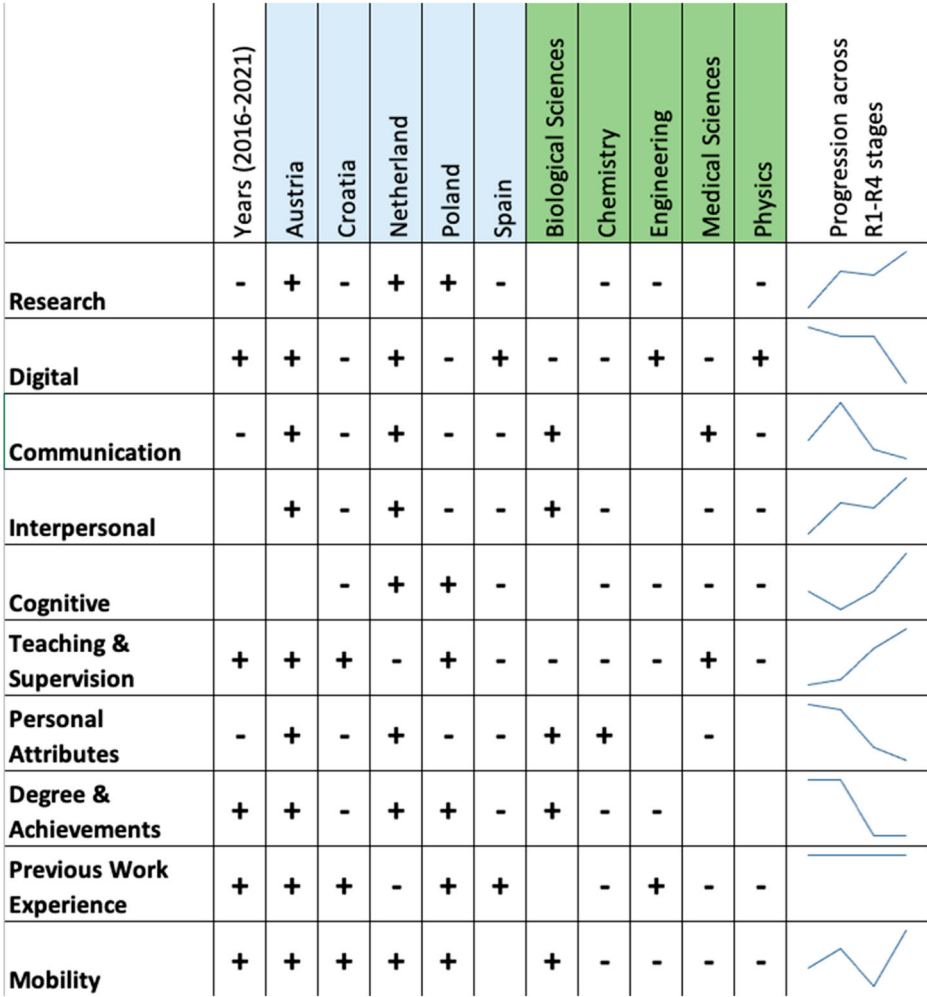|	Years (2016-2021)	Austria	Croatia	Netherland	Poland	Spain	Biological Sciences	Chemistry	Engineering	Medical Sciences	Physics	Progression across R1-R4 stages
Research	-	+	-	+	+	-		-	-		-	
Digital	+	+	-	+	-	+	-	-	+	-	+	
Communication	-	+	-	+	-	-	+			+	-	
Interpersonal		+	-	+	-	-	+	-		-	-	
Cognitive			-	+	+	-		-	-	-	-	
Teaching & Supervision	+	+	+	-	+	-	-	-	-	+	-	
Personal Attributes	-	+	-	+	-	-	+	+		-		
Degree & Achievements	+	+	-	+	+	-	+	-	-			
Previous Work Experience	+	+	+	-	+	+		-	+	-	-	
Mobility	+	+	+	+	+		+	-	-	-	-	

Figure 4. Aggregated summary of logistic regressions for the top five countries and top five disciplines per attribute category (+ positive relation, −negative relation).

trending, while Research, Communication, and Personal Attributes are decreasing in emphasis between 2016 and 2021.

Focusing on the progression of attributes across career stages, we find certain categories becoming less or more important across a career. While Research, Interpersonal, Cognitive, Teaching and Supervision gain importance over a career lifespan, Digital, Communication, Personal Attributes, and Degree and Achievements lose significance towards professoriate.

Discussion

The motivation to undertake this research stemmed from the lack of clarity on what is required at each academic level and to explore differences between disciplines and countries. We applied the theoretical lens of a career lifespan (Arthur, Hall, and Lawrence 1989; Zacher et al. 2019) and conceptualised academic careers as a four-tier system standing in relation between individual, organisational and societal needs (Baruch 2013; Harley et al. 2004). In this context, the academic career can be viewed as a string of professional experiences which cumulatively build achievements and

skills to help academics advance to the next tier. Studying academic careers is important as the higher education sector is expanding, with increasing significance to the economy (Baruch and Hall 2004). In the following we discuss the dominant attributes in academic careers overall and per stage, country and discipline differences, and trends and changes over time.

Regarding attributes, the results of this study show that Research strongly dominates the requirements in academic job data and further reinforces the long persistent 'publish or perish' narrative in the academy. However, we also find that Teaching and Supervision (i.e. independent of national context) is clearly rising in demand from R1 to R4 (see Figure 2). This contrasts the dominant belief that academia only promotes based on research (i.e. Dany, Louvel, and Valette 2011). It is apparent from our findings that although Teaching remains in secondary position to Research, it continues to be strongly in demand and successful applicants will need to invest time in developing their Teaching and Supervision skills to progress in academia. This may explain why the focus of academic development literature is centred around teaching development rather than research skill development (Åkerlind 2008; Matthews, Lodge, and Bosanquet 2014).

Aside from research and teaching, our data reveals other skills and attributes are requested of academics. Baruch (2013) find that career progression to higher levels usually involves moves from scholarly roles to managerial or service roles. Our data confirms that especially at R3–R4 stages, teaching, supervision, and curriculum work gain importance. Leadership, management, and other service-related type of attributes are in the Interpersonal category, which spikes in R2, stays fairly the same in R3 and then increases again in R4 (Figure 2) marking a shift to higher leadership expectations and increased responsibility at R2 and R4 type positions. Independent of discipline, we find that in senior roles (particularly R3–R4) money-raising activities (i.e. grant funding), curriculum development, supervising, and outward-facing activities like conference presence, feature amongst the top 10 attributes (Table 2). Overall, the top 10 do not necessarily show the large variety in attributes that we might expect from stage to stage. The core business of academic careers is clearly research and teaching and this applies to each stage.

Looking at change in job data over time helps to examine the effects of global trends towards marketisation and managerialism on academic careers (Harley et al. 2004). Our findings show that over time there has been an increase of job ads requesting attributes such as Digital skills, Teaching and Supervision, Degrees and Achievements, Previous Work Experience and Mobility. These trends can be explained by ongoing massification and rising accessibility of education that leads to heightened requirements in teaching, supervision and mentoring skill and experience (face-to-face and online), growing competition for talent and accomplished knowledge workforce amongst institutions and countries, which transcends national boundaries (Kaulisch and Enders 2005). We would expect the Enterprise category to be trending for the same reason, however, this category was the least mentioned in our data (Figure 2), and although rising in demand towards R3–R4 stages, it was excluded from further analysis. Across the period 2016–2021, the categories Personal Attributes, Communication, and Research decrease in the frequency in which they appear in academic selection criteria. That Research decreases over time is a surprising finding which could be interpreted in one of three ways: (1) that Research is a 'given' and that it does not need mentioning; (2) there are a greater number of 'alternative' academic job models (i.e. Professor of Practice or Industry Professor (Baruch and Hall 2004; Santoro and Snead 2013)) whose role might not require Research, or (3) that the status of 'publish or perish' is slowly fading in favour of other skill demands like raising research funds. For instance, the increased expectation of universities to engage with industry and community, requires (specifically senior and established) academics to invest time in outreach activities and use their reputation and standing to either raise funding, attract students, or initiate collaborations and partnerships with other institutions, industry, etc. (Santoro and Snead 2013). In any case, the temporal analysis suggests that career requirements evolve, and job criteria change quickly, further highlighting the value of job data analysis to understand the changing nature of academic careers.

In accordance with our results, previous research suggests that national settings and models of higher education systems significantly impact academic careers leading to formal and informal

rules and expectations for academics (Kaulisch and Enders 2005; Frølich et al. 2004), which warrants national comparison and a closer analysis at country-level. Our research data spans over 40 countries and a closer analysis of the five most represented countries (Figure 4) reveals which skills are more likely to be in demand in any given country. For example, the results indicate that job ads by Spanish universities are more likely to list attributes such as Previous Work Experience and Digital skills. These findings are important for the discussion on academic mobility. Previous research discussed that academics could benefit from developing skills that will provide 'external marketability' (e.g. Eby, Butts, and Lockwood 2003). As such, our findings have implications for academics' international mobility and is likely to provide helpful guidance to academics who are mobile and can go where their skills are in greater demand. Additionally, this research shows clear variation between disciplines (Figure 4). Comparing the five most represented (all located in STEM) disciplines, interdisciplinary mobility does not seem straightforward as each discipline preferences distinct types of attributes. We therefore recommend further examining job requirements at discipline-level.

Finally, this paper offers an 11-category-taxonomy for academic job skills and attributes that can be used by academics for self-assessment and professional training, and by universities as academic capabilities framework for promotion, performance review but more importantly professional development of academic staff. Specifically, academics can identify and compare their expertise and capabilities against job demands at each R stage, and plan and focus their training needs where it is needed the most. Academics can use these insights in professional development meetings with their managers or supervisors. Institutions can also use the insights in this paper to underpin their policies and signpost developmental initiatives for academics to support ongoing career trajectories. The paper offers insights that institutions and academic staff managers could use to benchmark and self-evaluate institutional performance.

Limitations

Skills are notoriously difficult to distinguish (Djumalieva and Sleeman 2018). Nevertheless, the taxonomy developed in this paper offers a common language for academic career researchers. Despite the big dataset we acknowledge that our data does not claim that all open academic positions are advertised online and on Euraxess. It is also possible that universities employ external agents and headhunters to recruit academic talent, especially in countries where governments have input into hiring decisions (Musselin 2013; Ferlie, Musselin, and Andresani 2008). This process might look quite different and is subject to future research. Our data does not show how open roles are filled (e.g. whether requested skills and attributes are found in a candidate, or whether successful candidates accepted the role). Further, we recognise there might be a discrepancy between what is advertised and what is actually sought (Parker et al. 1998), and that factors like gender, race, social capital, etc. play a significant role on academic career progression (Angervall, Gustafsson, and Silfver 2018; Zacher et al. 2019). We wish to reiterate that our analysis concerns pre-job-entry attributes, we do not measure whether selected candidates possess all attributes requested. We also acknowledge that various other changes in academic careers have recently been introduced which is out of scope in this research. For instance, education-focussed, or teaching-only positions have been introduced more recently in universities globally, however, these are still far outnumbered by combined or balanced academic roles that include research and teaching. It is important to acknowledge that the four-stage career model does not reflect the reality of many researchers, particularly those bound by short-term funded research.

Conclusion

In this paper we investigated what types of attributes are requested in academic job ads across and at each of the four stages of an academic career (PhD-professoriate). We draw on a large data set of 40,819 academic job ads which revealed the five most represented countries (Poland, Austria,

Croatia, the Netherlands, and Spain), and the five most represented disciplines (Medical sciences, Engineering, Physics, Biological sciences, and Chemistry). As such this paper makes a unique contribution of providing not only a way of describing academic job requirements through the means of a taxonomy, but importantly by offering empirical evidence to the body of literature on academic skills and academic career progression. This study helps in determining the attributes needed at different academic career stages, differences between countries and disciplines, and how over time the importance of such attributes rises or decreases. We find significant national and disciplinary differences in kinds of attributes requested, suggesting implications for international and interdisciplinary mobility in academic careers. Overall, the key factor in academic career progression is Research, however, Teaching and Supervision follow closely and gain strong importance at professorship levels. Global trends towards marketisation and managerialism in universities effect academic careers and progression, and this can be seen in the kinds of attributes trending over time. This paper provides a useful taxonomy of academic job criteria and attributes that can be used by researchers of academic careers, academics themselves, as well as institutions and research managers. Academics can identify and plan their training needs in line with academic ambitions, while institutions can use the insights to underpin their policies and support ongoing career trajectories.

Acknowledgement

Disclosure statement

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Appendix 1. Universities with the most job ads and their university ranking (Times Higher Education Rankings, 2023).

Row labels: University	Ads total	University ranking
University of Zagreb	1,474	Lower
University of Warsaw	885	Mid
University of Rijeka	755	Lower
Delft University of Technology (TU Delft)	629	Top
Wrocław University of Science and Technology	590	Lower
Medical University of Warsaw	529	Unranked
University College Cork	464	Top
University College Dublin	432	Top
Universitat Autònoma de Barcelona	404	Top
University of Bergen	377	Top
Veterinärmedizinische Universität Wien (University of Veterinary Medicine Vienna)	374	Unranked
Universitat de Barcelona	368	Top
Nicolaus Copernicus University	365	Lower
University of Copenhagen	353	Top
University of Rzeszów	347	Unranked
Medical University of Lodz	346	Mid
Wageningen University and Research	345	Top
Adam Mickiewicz University in Poznań	332	Lower
Jagiellonian University	325	Mid
Poznan University of Medical Sciences	317	Lower
Eindhoven University of Technology (TU/e)	314	Top
Universidad Politecnica de Madrid	309	Unranked
Babes-Bolyai University	293	Unranked
Warsaw University of Life Sciences – SGGW	293	Lower
University of Porto	289	Top
Universitat Pompeu Fabra	284	Top
Silesian University of Technology	273	Lower
University of Zadar	263	Unranked
University of Split	258	Lower
Universitat Politècnica de Catalunya (UPC)- BarcelonaTECH	257	Mid
University of Zielona Góra	234	Unranked
University of Twente (UT)	225	Top
Maria Curie-Sklodowska University In Lublin	219	Unranked
University of Szczecin	213	Unranked
AGH University of Science and Technology	212	Lower
University of Minho	212	Mid
The Maria Grzegorzewska University	207	Unranked
University of East Anglia	190	Top
University of Warmia and Mazury in Olsztyn	180	Lower
Utrecht University	178	Top
University of Amsterdam (UvA)	176	Top
University of Wroclaw	168	Lower
Maastricht University (UM)	167	Top
Université Catholique de Louvain (UCL)	162	Top

Continued.

Row labels: University	Ads total	University ranking
Vrije Universiteit Amsterdam (VU)	157	Top
Universidade de Coimbra	155	Mid
Cardiff University	154	Top
Pomeranian University in Słupsk	153	Unranked
Kazimierz Pulaski University of Technology and Humanities in Radom	151	Unranked
Medical University of Silesia	149	Lower
University of Lodz	149	Lower
Hasselt University	148	Top
Swansea University	146	Top
NUI Galway	178	Top
State University of Applied Sciences in Nowy Sacz	142	Unranked
University of Groningen	140	Top
Université Libre de Bruxelles (ULB)	137	Top
Tallinn University of Technology	135	Mid
Medical University of Lublin	133	Unranked
University of Applied Sciences in Nysa	129	Unranked
Radboud University	128	Top
University of Crete	127	Top
University of Vienna (Universitaet Wien)	127	Top
University of Tartu	124	Top
Pomeranian Medical University in Szczecin	116	Unranked
Trinity College	116	Top
Radboud University Medical Center (Radboudumc)	111	Unranked
University of Silesia in Katowice	109	Lower
University of Limerick	108	Mid
University Politehnica of Bucharest	108	Lower
University of East Sarajevo	104	Unranked
Leiden University	103	Top
Universidade de Vigo	103	Lower
Institute of Organic Chemistry Polish Academy of Sciences	100	Unranked
Université Grenoble Alpes	99	Top
Medical University of Bialystok	98	Lower
Universidad de Zaragoza	98	Lower
Dublin City University	97	Top
West Pomeranian University of Technology, Szczecin	97	Unranked
SGH Warsaw School of Economics	96	Lower
University of Dundee	95	Top
Lublin University of Technology	94	Unranked
RCSI - Royal College of Surgeons in Ireland	94	Unranked
Graz University of Technology	93	Mid
Wrocław University of Science and Technology	91	Lower
Alexandru Ioan Cuza University of Iasi	90	Lower
Universidade do Minho	89	Mid
Technical University of Liberec	83	Lower
Cracow University of Economics	82	Unranked
Politécnico de Leiria	82	Unranked
Karl-Franzens-University Graz	80	Mid
The University of Agder	80	Unranked
Wroclaw Medical University	80	Top
University Of Macedonia	77	Unranked
Erasmus University Rotterdam (EUR)	72	Top
Universidad de Lleida	71	Mid
Johannes Gutenberg University Mainz	70	Top
Kielce University of Technology	70	Unranked
Instituto Politécnico de Bragança	68	Lower

Notes:
Top-ranked universities are grouped from 1 to 500.
Mid-ranked universities are grouped from 501 to 1000.
Lower-ranked universities are grouped from 1001 to 1500+.