SRHE Society for Research into Higher Education

How are we positioning apprenticeships

Research report

January 2021

Dr. Khristin Fabian
Dr. Ella Taylor-Smith
Edinburgh Napier University

Edinburgh Napier UNIVERSITY

Contents

Acknowledgements

We would like to thank the Society for Research into Higher Education (SRHE) for supporting and funding this project.

We are also grateful for the support and advice offered by Dr. Ciaran Burke who was appointed by the SRHE as a critical friend.

We also acknowledge the help of Katherine Stephen, who helped to analyse the adverts and delivered the outputs on time despite the challenges posed by the current pandemic.

Executive Summary

Background:

As part of the UK government's drive to boost the skills of the workforce, they have committed to delivering 3 million apprenticeship starts between 2015-2020 (Institute for Fiscal Studies, 2017). Degree apprenticeships are collaborations between employers and universities, to deliver work-experienced graduates, with skills aligned to industry needs. Degree apprentices are salaried employees, spending 80% of their time working, including work-based learning, and 20% studying away from the workplace (e.g., at university). Organisations with a pay bill of £3 million contribute 0.5% of their salary cost to the Apprenticeship Levy (Powell, 2019). Course fees are then paid from the levy. Employers recruit the apprentices.

This scoping research used 290 IT degree apprenticeship job adverts from England and Scotland's official apprenticeship websites to get insight into employers' strategies for apprenticeship recruitment, especially their expectations of their apprentices. Specifically, this study aims to answer the following research questions:

1. What skills, attributes, experience, and qualifications do employers look for in IT apprentices?
2. What are the job responsibilities advertised?
3. What is the alignment between the advertised job tasks and expected learning outcomes as specified in apprenticeship standards?

Key Findings:

- There is a wide variation in the initial salary offerings for first year degree apprentices, with an average of £16696. About 49.7% of the adverts offered equal to or above the national minimum wage of £8.19 in 2019 and 31.6% of the adverts were below this.
- Advertised entry routes to degree apprenticeship align with the traditional qualifications sought by universities with an emphasis on obtaining specific A Level/Highers marks. Alternative routes were not always mentioned in the adverts and few adverts mentioned work experience as a way to start the apprenticeship.
- Direct entry to second or third year of the degree apprenticeship was not mentioned in the adverts. So, while some adverts mentioned alternative routes, options to progress from previous qualifications were not clear.
- Currently, the job adverts seem to favour the opportunities for employers to recruit people who already possess many of the skills that the degree apprenticeships are promoted as providing. Communication skills, problem-solving skills and interpersonal skills are among the skills valued in graduate-level IT roles and these mirror the soft skills/attributes sought from prospective apprentices prior to starting their undergraduate studies. It seems that the skills being sought at recruitment are the same skills that employers were seeking (and claiming to find lacking) in graduates and the same skills that the apprenticeships aim to develop, leading to questions about the extent to which these are personal attributes or skills to acquire during (or before) higher education and work-based learning.

- Most of the job adverts focus on the training that the apprentices will be receiving as part of the programme. Tasks specific to subjects are not always specified which makes it difficult to analyse how the adverts align with the apprenticeship standards.

Future directions for research

By exploring the job advertisement data, we identified the requirements employers explicitly specify for their apprentices. These could usefully be further investigated in terms of widening participation goals, as well as within discussions about teaching, learning, acquiring, or innately possessing soft skills. This study found a wide variation in the offerings provided by different companies, particularly in salary, opportunities, and clarity of the responsibilities in the job roles that apprentices will be committing to as they also complete degree study. Future research could look at standardisation of apprenticeship programs, explore the marketing aspect of degree apprenticeships, ask employers about recruitment decisions, alignment of employer roles and universities, as well as investigate how the job adverts represent the tasks that apprentices would be doing in their roles.

Main Report

Introduction

The UK's evolving apprenticeship policy has two explicit aims: to increase productivity and social mobility (QAA 2019), leading to the UK government's ambitious commitment to deliver 3 million apprenticeship starts between 2015 and 2020 (Institute for Fiscal Studies 2017). Productivity is to be increased by driving up skills levels, thus maximising national competitiveness (QAA 2019). In particular, a sizeable skills gap has been identified in terms of digital skills. Shadbolt's (2016) report, released just prior to the trailblazer (pilot) phase of degree apprenticeships in England (Universities UK 2017), highlighted the gap between predictions of the number of digitally-skilled workers needed to fill roles (based on UKCES 2015 data) and contemporary Computer Science graduates from UK universities. However, as well as a gap in the number of graduates, the digital skills gap discourse also feeds back employers' complaints that computing graduates do not arrive 'oven ready', but lack soft skills, specific technical knowledge, business awareness, and work experience (Shadbolt 2016). In parallel, the Wakeham review (2016) notes a decline in employers' investment in on-the-job training. So the (graduate) digital skills gap has three elements: shortfall of computing graduates, graduates not meeting employers' skills needs, and lack of training for employees (cf. Taylor-Smith et al. 2019). Within the UK's apprenticeship policy, degree apprenticeships aim to match employers' needs to graduates' skills by providing opportunities that "explicitly develop professional competence" (Rowe, Perrin, and Wall 2016, 365).

Using job advertisement data collected from March 2019 to March 2020, this research project aims to map the IT-related degree apprenticeship offerings in England and Scotland. This will provide information about the apprenticeship labour market. It will also give an insight into employers' strategies for both skills recruitment and development, as they look for employees prior to starting their degrees, rather than on completion. Specifically, this study aims to answer the following research questions:

1. What skills, attributes, experience, and qualifications do employers look for in IT apprentices?
2. What are the job responsibilities advertised?
3. What is the alignment between the advertised job tasks and expected learning outcomes as specified in apprenticeship standards?

Review of literature

Degree apprenticeships

Degree apprenticeships are collaborations between employers and universities to deliver work-experienced graduates, with skills aligned to industry needs. Apprentices are salaried employees, spending 80% of their time working, including work-based learning, and 20% studying away from the workplace (e.g., off-the-job at university).

The degrees are mostly funded by employers, with fees paid from the Apprenticeship Levy and employers paying their apprentices' salaries. From April 2017, all UK employers with an annual pay bill of over £3 million, paid 0.5% of their pay bill into the Apprenticeship Levy (Powell 2019). Degree apprenticeships in Scotland (known as graduate apprenticeships) were also initially sponsored by the European Social Fund (SDS 2019). While not trumpeted as an objective, this

financial model also serves to counter the shift of the costs of higher education (HE) study onto individual students and their families (Burke et al. 2017), which has proved to be a stumbling block for widening participation to students from less wealthy backgrounds (Hoskins and Ilie 2017) (as well as hastening the marketisation of HE (Brosnan 2017) which is beyond the scope of this report). The finances of degree apprenticeships are promoted to (prospective) apprentices as "Earn as you learn" (Smith et al. 2020), including variants on "Get a job, get paid and get a degree at the same time" (SDS 2020) and these finances are key to their potential for social mobility (QAA 2019).

In practice the skills and social mobility aims come together in the central role of the employers: they fund the lion's share of the training costs and pay apprentices' salaries; they influence the curricula through input into the frameworks (or standards) that govern the contents of the degrees (Powell and Walsh 2018); and they recruit the apprentices: QAA position employers as the "primary gatekeeper for admissions working closely with the higher education provider" (2019, 4). These entwined aspects of the employers' role in degree apprenticeships are the focus of this study, investigated through the medium of recruitment adverts, placed by UK employers.

Skills and attributes

Within the degree apprenticeship, in England and Wales, employers are in the driving seat, helping to set the standards/competencies they require in collaboration with higher education institutions (HEIs) (Bravenboer 2016). In Scotland, while graduate apprenticeships are developed by businesses, Educational Institutions (EIs) collaborate to "create the right balance of conceptual understanding and practical experience" (SDS 2019, 23), with Skills Development Scotland moderating development and delivery, and awarding places to EIs. With this new role for employers, it is important to ask what employers are looking for in prospective recruits and what tasks are described for these prospective apprentices.

It should also be noted that, at time of writing, most degree apprentices were already employed by their employer when they started their apprenticeship, rather than recruited into the role via an advert. Two-thirds of people starting their degree apprenticeship in 2018-19 had already been with their employer for more than 12 months (Hubble and Bolton 2019). Interestingly, this varied with age: 83% for those aged 25+ and 14% for those under 19. SDS' (2020) figures for degree apprenticeships in Scotland are that 71.2% of apprentice starts were existing employees in 2017/18 and 70.6% in 2018/19.

The computer science and IT landscape varies greatly, from software and hardware development, cyber security, cloud computing to data analytics, business, and social informatics. Jobs for computing graduates, in these different sectors require some different skills, while other skills are shared. Shadbolt's review noted how employers require different skills from prospective graduate employees, some emphasising technical skills and others prioritising soft skills (2016, 2).

EIs' investigations into the skills that employers look for in graduates and how to instil them is generally couched in terms of employability. While this is a highly sought-after quality, it is weakly conceptualised (Belhe 2020). In practice, EIs identify and try to cultivate technical and soft skills in their students that reflect surveys of employers' needs (or requests). The Institute of Student Employers (ISE) surveyed their members at the beginning of 2020. The skills they need entry-level graduates to have are, in order of popularity: teamwork; interpersonal skills; listening; problem-solving; taking responsibility; time management; self-awareness; business-appropriate communication; resilience; dressing appropriately; numeracy; staying positive; emotional intelligence; writing; commercial awareness; IT/digital skills; presentation skills; job-specific technical skills; data handling/data analysis; Excel skills; negotiation/influencing skills;

leadership; dealing with conflict; managing up; and career management (ISE 2020). Sourced from employers in various sectors, the most requested non-technical attributes largely reflect those listed by Shadbolt (2016) and the studies cited below. However, attributes such as business-appropriate communication and dressing appropriately could also be interpreted as signifiers of cultural fit, rather than graduate skills per se (Tomlinson and Anderson 2020). Notably, ISE also asked employers what they needed from non-graduate entry-level hires and dressing appropriately (a signifier) was one of the few attributes considered more important for the non-graduates. It will be interesting to see whether the job advert data in this study aligns more closely to employers' needs for graduate or non-graduate hires.

Job advert studies

Several studies have adopted the use of job advertisements to analyse graduate-level IT job requirements. For example, in a review of job postings for data analysts, Verma et al. (2019) found that decision making, organisation, communication, and data management are among the key skills required from data analysts. For developers, key skills include technical skills, project management; soft skills such as problem-solving, team player and communication skills are also frequently mentioned in job adverts (Ahmed et al. 2011; Florea and Stray 2019; Mcgill 2009). For cyber security professionals, technical skills, business skills, and interpersonal skills were common requirements for posts (Parker and Brown 2019). These examples illustrate that while there may be a variation in the tasks and the technical skills required from potential IT recruits, there is an alignment in the soft skills required in IT roles. In Shadbolt's (2016) review of computer science graduate employability, technical skills, soft skills, and project management are the range of skills employers look for. The skills identified through the job advert studies align with this report and illustrate how analysing job advert data is a potentially useful strategy to identify employers' job requirements.

Methodology

The study uses content analysis to analyse job adverts for IT and Computing degree apprenticeships. Content analysis is a systematic process to analyse qualitative data to identify consistent patterns and relations between variables and themes (Julien 2008). Through the systematic coding of content into different pre-determined categories, it allows for the number of occurrences to be quantified and themes interpreted (Payne and Payne 2004).

Job advert data has been used in studies to identify the changing nature of skills in the workplace (Harper 2012). It is also useful for identifying the range of duties and responsibilities for ill-defined roles (for example, Pitt and Mewburn 2016)) and has also been used to compare curriculum content with employer expectations (Behpour et al. 2019). Smith et al. (2020) used an early survey of Scotland-based degree apprenticeship job adverts to provide (and lightly critique) employers' perspectives of the new programme. As the degree apprenticeship (DA) programme is relatively new, the use of job adverts could provide useful information about the degree apprenticeship recruitment landscape.

Job adverts were gathered from two government websites: apprenticeships.gov.uk and apprenticeships.scot from March 2019 to March 2020. A total of 370 adverts were collected. Data from these adverts, such as candidate requirements, job description, and salary, were extracted and analysed using a coding protocol.

The coding framework was developed, following discussions with the research team, to map out the difference in job offerings, person specifications, and tasks required from apprentices. Findings from the literature were used to help frame the coding categories for skills (for example, Shadbolt's report on skills that computer science graduates lack was used as the framework for coding the skills) while the apprenticeship standards were used to identify the categories for tasks. One researcher coded all the adverts while another researcher independently coded 10% of the sample. Inter-rater reliability was .71 Cohen's kappa which means that there's substantial agreement.

The job adverts were categorised into the various IT apprenticeship frameworks. The original intention was to code similar degrees in England and Scotland into the same framework. However, the templates for the apprenticeship frameworks for the two nations were quite different, so data from these two versions of degree apprenticeship were kept separate. In Scotland, there are four established apprenticeship frameworks:

- IT: Cyber Security
- Data Science
- IT Management for Business
- IT Software Development

In England, there are five listed apprenticeship standards:

- Cyber Security
- Data Science
- Digital and Technology Solutions (DTS)
- Creative Digital Design
- Digital User Experience

The DTS degree has several specialisations: business analyst, cyber security specialist, data analyst, network engineer, IT consultant, and software engineer. As set out in the apprenticeship standard for the DTS apprenticeships, "all apprentices will require the core skills and knowledge to be combined with the specialist skills but employers will need to select only one of the

specialisms for the apprentice" (Institute for Apprenticeships 2019). However, in the English-based job adverts, most of the time the specialisation pathway for DTS is not identified, so these were coded under the more general category Digital and Technology Solutions. The Creative Digital Design and Digital User Experience degree apprenticeships were two recent additions to the standards and these were not captured in the adverts collected.

Duplicate job posts (same role and same content) from the same company were removed to ensure that this did not affect the frequency of summaries related to tasks and skills identified in the job adverts as shown in Tables 2-6. For example, if Company A listed a post 10 times, and highlighted the need for "willingness to travel" in these adverts, this affects the overall frequency whereas the need for "willingness to travel" is in fact from multiple occurrences of the same job advert from the same company. Adverts for *different* positions from the same company, regardless if the content is the same, were not removed. Similarly, adverts for the *same position but with substantially different content* from the same company were also retained as separate adverts. Removing the duplicates narrowed the adverts from 370 (as indicated in Table 1) to 290 (as shown in Tables 2-6).

Results

Job offerings

An initial 370 IT degree job adverts comprising of 1445 positions, advertised through Apprenticeships.Scot and England's Find an Apprenticeship service, were collected from March 2019 to March 2020. These adverts were from 174 different companies and delivered in partnership with 45 different learning institutions (FE, HE, and private learning providers).

A breakdown of the job adverts by pathway is listed in Table 1, along with the average salaries by pathway. The minimum starting salaries for the apprenticeships ranged from £7500 to £30000 and this was the case for both apprenticeships based in England and Scotland (referred to below for simplicity as English and Scottish apprenticeships). The mean annual salary was £16696 (SD=£3341) with a mean hourly wage of £8.62 (SD=£1.75). About 67% (248) of the adverts fall within this range (£13355 – £20037). Three adverts were advertised at the minimum wage for apprentices (£3.90 per hour between April 2019 – March 2020). About half of the adverts (49.7%) advertised salaries greater than the national minimum wage of £8.21 in 2019. However, some adverts (n=55; 14.9%) did not specify the salary for the post, so these adverts were not included in the computed average. Permanent employment was offered as a possibility in 86 out of the 370 adverts. The proportion is lower if multiple postings from the same employer were accounted for (46 out of 290 adverts).

Table 1. Frameworks and average salary by pathway

English Frameworks	Number of Adverts	Number of Posts	Average Salary	Min	Max
Cyber Security	5	7	15545	14500	16200
Data Science	37	94	18334	10900	22000
Data analyst - (DTS)	12	32	18333	16100	21500
Digital and Technology Solutions (DTS)	194	779	16730	7500	30000
IT - (DTS)	8	84	15562	15600	15600
Network Engineer - (DTS)	6	42	20167	18000	21500
Software Engineer (DTS)	54	228	15339	8400	22000
Scottish Frameworks					
Cyber Security	7	7	16043	13000	18500
Data Science	6	28	17208	14300	18500
IT Management for Business	10	29	18503	16200	24400
IT Software Development	32	115	15166	7600	30000
Total	370	1445	16696	7500	30000

Skills, attributes, and qualifications required

The analysis provided in the succeeding section contains a smaller sample of the adverts (n=290) after duplicates have been removed to ensure that multiple job adverts by the same company do not skew the results.

The academic qualifications sought for starting degree apprenticeships are aligned with the requirements of the training providers. The majority of the posts in England mentioned A Levels in their requirements (94.3%), but 35.7% of those did not specify the grades needed. Having appropriate UCAS points was specified in 60.7% of the adverts in England. A breakdown of the A Level grades or equivalent UCAS points required for the degree apprenticeship is shown in Table 2. For adverts that specified the A Level grades or UCAS points, 45.1% required UCAS points between 96 and 112 or an equivalent of CCC to BBC. There was also a requirement to have either a Level 2 or Level 3 maths qualification (73.8%).

The academic requirements for Scotland-based apprenticeships reflect the same scenario, as shown in Table 3. Other than one job advert not specifying any grade requirement, having Highers was specified as one of the routes to gain entry to the apprenticeship. Highers achieving BBBB was mentioned as a requirement in 65.2% of the posts with some posts requiring as much as AAAA (13%). Having a qualification in maths is a requirement for most adverts (84.8%) but there is more emphasis on obtaining at least a Higher in maths (78.3%)

Table 2. Academic requirement for degree apprenticeships in England

Academic Requirement (UCAS Points or A Levels)	Number of Adverts	Percentage
96 (CCC)	41	16.8%
104 (BCC)	24	9.8%
112 (BBC)	45	18.4%
120 (BBB)	21	8.6%
128 (ABB)	3	1.2%
136 (AAB)	13	5.3%
144 (AAA)	1	0.4%
Maths requirement	180	73.8%

*n=244 with duplicates removed

Table 3. Academic requirement for degree apprenticeships in Scotland

Academic Requirement (Highers Required)	Number of Adverts	Percentage
AAAA	6	13.0%
AAAB	2	4.3%
ABBB	1	2.1%
BBBB	30	65.2%
BBBC	3	6.5%
BCC	1	2.2%
Not specified	1	2.2%
Maths requirement	39	84.8%

*n=46 with duplicates removed

Other routes into the apprenticeship degree were also specified in the adverts and a breakdown of these is listed in Table 4. In Scotland, alternative entry routes (aside from the Highers requirement) include completion of a lower-level apprenticeship (20%), an HND or BTEC qualification (24.4%) or work experience (42.2%). While the proportions for alternative entrance routes seem to be the same with the England-based degree apprenticeships, the numbers in England could be higher as these qualifications have equivalent UCAS points. However, having work experience, was mentioned more in the Scotland-based apprenticeships, 42.2% vs 12.3%.

Table 4. Other entry routes to degree apprenticeships

Alternative pathway	Scotland	England	Total
Apprenticeship	9 (20%)	42 (17.1%)	51 (17.5%)
Higher National Diploma or BTEC	11 (24.4%)	82 (33.5%)	93 (32.0%)
Work experience	19 (42.2%)	30 (12.3%)	49 (16.9%)

The structures of the Scottish and English templates for apprenticeship adverts had an effect in how the requirements were presented in the adverts. In the English adverts, there were separate subheadings for desired skills, personal qualities, and qualifications; whereas, in the Scottish apprenticeships, there was a heading reading “what qualification or qualities are required.” Due to this structure, a few job adverts (13 of 46; 28%) have not specified skills or personal attributes required and only specified the qualifications needed to be able to join the programme.

As for the skills required, across the English computing apprenticeships there was an emphasis on communication skills (76.2%), on being a team player (72.5%), and being self-motivated and an independent learner: (71.7%). For Scotland-based apprenticeships, there was an emphasis on interest in IT (60.9%), being an independent learner (47.8%) and having good problem-solving skills (34.8%). See Table 5 for more details on skills and attributes required.

Table 5. Skills and attributes required for the post

Skills and personal attributes	Scotland (46)	England (244)	Total (290)
Communication	12 (26.1%)	186 (76.2%)	198 (68.3%)
Self-motivated /Independent	22 (47.8%)	175 (71.7%)	197 (67.9%)
Problem-solving skills	16 (34.8%)	169 (69.3%)	186 (63.8%)
Team player	4 (8.7%)	177 (72.5%)	182 (62.4%)
Technical skills	13 (28.3%)	158 (64.8%)	172 (59.0%)
IT interest	28 (60.9%)	123 (50.4%)	152 (52.1%)
Time and project management	4 (8.7%)	134 (54.9%)	138 (47.4%)
Detail-oriented	3 (6.5%)	109 (44.7%)	112 (38.6%)
None specified	13 (28.2%)	0 (0.0%)	13 (4.5%)

Job responsibilities and apprenticeship standards

The adverts from the two websites follow a different template in terms of the job overview. For the England-based apprenticeship, the structure of the advert includes an apprenticeship summary, which typically lists the responsibilities and duties associated with the post. The Scotland-based apprenticeship includes a job overview and a section on what apprentices will be learning. Due to this structure, there is sometimes an overlap between information about the tasks that the apprentices will be doing and the topics that they will be learning as part of the work-based learning programme. For example, one advert describes the learning activities as

> *You will start your career with Company A as a tester, with opportunities to progress in software development as you gain more experience. [paraphrased for anonymity]*

However, some adverts only described the learning activities (n=47;16.2%), with an emphasis on the training and support that apprentices will receive, while key responsibilities of the job were not outlined; so, it was not possible to categorise these tasks. Below is a paraphrased example of an advert that did not specify the tasks involved:

> *What you do in work will count towards your degree. You will gain experience in:*
>
> - *Software development*
> - *Project management*
> - *Interpersonal skills*

For some of the adverts (n=13; 4.5%), the level of details provided about the tasks of apprentices provided very little information about the job (information is paraphrased to keep anonymity).

> *We are a tech company delivering business solutions.*
>
> *You will be part of a team.*

At the start of the apprenticeship, you will receive training to help you start your career with us. As part of the training programme, you will also spend time at university.

The job involves travel, so you need to be flexible.

The rest of the adverts did provide details about the tasks (n=231; 79.4%). A breakdown of the categories of tasks by framework is listed in Table 6. Appendix A provides examples of tasks associated with these categories.

Aspects of software development were common in the tasks across the different IT apprenticeship degrees (including pathways within the DTS degrees). This is probably due to more opportunities for the software development pathway in the DTS framework although not specifically labelled as such. Other pathway-specific tasks like those relating to cybersecurity, networks, and data science were mentioned far less in comparison to the software development-related tasks. Regardless of the subject, however, tasks relating to project management came out as a common responsibility of the apprentices (n=142, 49%). Tasks relating to the development of business skills were also common (n=124, 42.8%). There was also an emphasis on the development of interpersonal skills across the frameworks (n=100; 34.5%).

It was initially planned to do an analysis of the different tasks by pathway and/or degree, however, this wasn't possible for all pathways due to the low number of adverts per pathway and/or degree and because tasks specific to pathways were not always specified. For example, one data science advert specified the different responsibilities, such as liaising with stakeholders and building knowledge about the business but did not specify tasks that are specific to the data science framework, such as data analysis, management, or engineering. This was also the case for cyber security, where the majority of the adverts for both England and Scotland (55%) did not specify cyber security-related tasks. Subject-specific tasks were more specific for the software development related projects, as indicated in Table 6. These roughly align with some of the skills listed in the DTS Software Engineer Pathway, such as:

- Creating and delivering software solutions (77% of the software development posts)
- Performing code reviews and debugging (37%)
- Testing code to ensure functionality (53%).

What is apparent overall, is that some of the adverts, despite giving some indication about the tasks and responsibilities, did not specify tasks related to the pathway/subject. This means that the original intention to map the tasks with the apprenticeship framework could not be fully met.

Table 6. Categories of tasks by apprenticeship framework

	N	Business Skills	Project management	Develop interpersonal skills	Cyber Security	Networks	Software development	Support and Debugging	Testing	Data analysis	Data management
Data Science	27	20 (74.1%)	8 (29.6%)	6 (22.2%)	-	-	-	-	-	13 (48.1%)	6 (22.2%)
Data Science (Scotland)	5	2 (40%)	2 (40%)	2 (40%)	-	-	-	-	-	-	-
Cyber security	3	1 (33.3%)	-	-	2 (66.7%)	-	-	-	-	-	-
Cyber security (Scotland)	6	4 (66.7%)	4 (66.7%)	4 ((66.7%)	2 (33.3%)	-	-	-	-	-	-
Software Development (Scotland)	28	12 (42.9%)	14 (50%)	10 (35.7%)	-	1 (3.6%)	19 (67.9%)	10 (35.7%)	14 (50%)	0	1 (3.6%)
Software Development (DTS)	53	13 (24.5%)	24 (45.3%)	28 (52.8%)	2 (3.8%)	3 (5.7%)	43 (81.1%)	20 (37.7%)	29 (54.7%)	2 (3.8%)	-
ITMB (Scotland)	7	3 (42.9%)	3 (42.9%)	2 (28.6%)	1 (14.3%)	-	-	-	-	1 (14.3%)	-
DTS	161	69 (42.8%)	87 (54.0%)	48 (29.8%)	12 (7.5%)	31 (19.3%)	89 (55.3%)	54 (33.5%)	24 (14.9%)	26 (16.1%)	8 (5.0%)
Total	290	124 (42.8%)	142 (49.0%)	100 (34.5%)	19 (6.6%)	35 (12.1%)	151 (52.0%)	84 (29.1%)	67 (23.1%)	42 (14.5%)	15 (5.2%)

Note: percentages are row percentages

Discussion

The job adverts identified a wide variation in terms of the salary of the apprenticeship with a range from £7500 to £30000, some set at the minimum apprenticeship salary of £3.90 and about 50% advertised at slightly higher than the minimum hourly wage rate. The Incomes Data Research (2019) reported that the hourly salary of first-year degree apprentices is £9.14. However, the computed hourly wage for the advertised IT degree apprentices was significantly lower at £8.62 (SD=1,75). Previous studies on degree apprenticeships have suggested a need to standardise the approach to the administration and governance of degree apprenticeships in relation to the academic aspects of work-based learning (Dawson and Osborne 2020). We suggest that standards are also needed for employers joining the programme, for example to ensure that degree apprenticeship isn't used as an excuse to pay workers on a lower salary scale. An offer at least over the average degree apprenticeship wage pay could avoid the perception of low pay.

Providing training to apprentices is a substantial financial commitment (Gambin and Hogarth 2016) and one of the aims of the degree apprenticeship is to meet employers' skills needs (Rowe et al. 2016). SDS (2019) provide the following quote from one of the DA employers:

> "Graduate Apprenticeships are a fantastic opportunity for Aegon to attract and retain talented individuals in our organisation and at the same time take advantage of the levy we pay. The Graduate Apprenticeship has been designed with the needs of our industry in mind, which means that we have complete confidence that the learning they get at college or university is relevant and will enable them to contribute to our success now and in the future" (p.25).

So it was surprising that employers, after spending money to train apprentices, rarely specified the possibility of a permanent post at the end of the apprenticeship. However, QAA (2019) emphasise the transferability of the qualification, as an advantage to both apprentices and their employers; Smith et al. (2020) suggest that "employers may be more vulnerable to apprentice mobility due to the sector-based approach to framework design" (p.16).

The academic qualifications cited in the adverts align with the traditional qualifications sought by universities with an emphasis on obtaining specific A Level/Highers marks. The Policy Connect (2019) report noted that potential apprentices are recruited from schools and colleges, thus suggesting that recruitment is from the same pool as other higher education recruitment (Lester 2020). While alternative routes were identified in some adverts (see Table 4), information on progression was not provided (for example, direct entry to 2nd or 3rd year of the apprenticeship if an applicant already has a Higher National Diploma). Lester (2020) suggested that there is a need to promote degree apprenticeships beyond the traditional A Level cohort. Given that the degree apprenticeship is an alternative pathway to obtaining a degree, then having alternative entry routes should also be expected. In their original technical specifications for degree apprenticeships in Scotland, SDS promoted flexibility in terms of entrance routes, including entering directly into the second or third year of the degree with appropriate qualifications (such as the relevant Higher National) (SDS 2016) but this flexibility is not reflected in the Scotland-based job adverts.

Communication skills, problem-solving skills and interpersonal skills are among the skills valued in most graduate level IT roles (Florea and Stray 2019; McGill 2009) and these mirror the soft skills/attributes sought from prospective apprentices who will just be starting their first year of undergraduate studies. It seems that the skills being sought at recruitment are the same skills that employers were seeking (and finding lacking) in graduates (cf. Shadbolt 2016) and that the apprenticeships aim to develop, leading to questions about the extent to which these are personal attributes or skills to acquire during (or before) higher education and work-based learning. For example, in Barr and Parkinson's (2019) survey of potential employers for software engineering apprentices, one employer suggested that a more introverted apprentice may struggle with

teamwork and not thrive in their organisation. Meanwhile, other employers suggested that the majority of work being teamwork, especially compared to the relatively light teamwork involved in a traditional degree, was an asset of work-based learning. There is also an emphasis on being self-motivated and an independent learner. So, while most of the roles highlight that apprentices will be working as part of a team and that they will receive guidance from mentors, this requirement signals that the mentor's support may be limited and that there is an aspect of responsibility/independence associated with the role. This may reflect that degree apprenticeships can be quite hard work: UCAS warn that "young people need to ensure they are well prepared for the rigours of working and studying for a degree at the same time" (2017, p40). UCAS also note that the selection processes for degree apprenticeships can be extremely competitive and favour already privileged applicants.

Technical skills were also required in some of the posts. Some of these skills could easily be met (for example, knowledge of Excel) but other technical skills required will more likely be met by people who already have a computing background (for example, a software engineer post required knowledge of programming and coding languages and knowledge of C, C++ or Java). While qualifications such as Higher Computing include some programming, schools may choose to deliver this in simpler languages, such as Python or Visual Basic, rather than a more concept-heavy language such as Java, which is a mainstay of software development modules in HE. While previous studies have indicated that IT apprentices have some technical background (Taylor-Smith et al. 2019) there is a variation in the level of technical skills apprentices have (Somerville et al. 2020). This raises the question of whether the inclusion of specific technical skills steers away those with limited technical backgrounds.

Most of the job adverts focus on the training that the apprentices will be receiving as part of the programme. Indeed, the workplace would be the primary site of learning and knowledge generation, a signature pedagogy of work-based learning (Lester et al. 2016). Drewery et al's (2020) research on job attractiveness of work-based learning adverts found that signalling learning opportunities enhances job attractiveness for apprentices, as opposed to traditional job adverts. As potential apprentices may have limited work experience, highlighting these opportunities make the post more attractive to applicants.

Lillis and Bravenboer (2020) described degree apprenticeships as "first and foremost a job, with a specified training programme" (p. 729). One of the original intentions of this review was to match the job description with the apprenticeship framework; however, due to the content of the job adverts (e.g. how the jobs were described), it was necessary to use broader categories for the tasks rather than subject-specific ones. For example, within the data science tasks, data engineering and machine learning were among the initial categories, however, because very few adverts featured these tasks, the categories were dropped: the overall goal of the coding of job adverts was to identify *tasks common across adverts*. While some adverts missed out the information about the work responsibilities, most job descriptions provided some details on what the work entails, especially focusing on duties with regards to project management, developing business, and interpersonal skills. Tasks that were more technical and subject-specific were not always clearly defined.

The use of non-technical wording for tasks, for example "you will be part of a team delivering technology solutions to our clients", may be limited in its capacity to orient prospective applicants about the nature of the role, especially compared to descriptions such as "you will be using technologies such as blockchain to solve client problems". However, as Drewery et al. (2020) have pointed out, work-based learning applicants are likely to have limited work experience and knowledge of the subject, so more technically phrased duties may be less appealing to applicants

who are new to IT. Future research could usefully investigate the link between what has been promised in the advert and the actual work.

In terms of social mobility, degree apprenticeships have been accused of perpetuating the barriers associated with conventional higher education by using the same entrance requirements, as well as through rates of pay and misconceptions about the degree apprenticeship (Lester 2020). Job adverts are essentially communication tools. Carefully crafted job adverts geared for apprentices could signal the opportunities available within this programme. However, currently the job adverts seem to favour the opportunities for employers to recruit people who already possess many of the skills that the DAs are promoted as providing.

Conclusion

The degree apprenticeship is a significant – potentially disruptive – change in the delivery model of higher education. The degree apprenticeship is relatively new and employers' engagement with, and ambitions for, the programme need to be investigated. By exploring the job advertisement data, we identified the characteristics (skills, attributes, qualifications etc.) that employers seek in their apprentices. These could usefully be further investigated in terms of apprenticeship goals on widening participation, as well as within discussions about teaching, learning, acquiring, or innately possessing soft skills and even *metaskills* (CWBL 2018). This study has also found a wide variation in the offerings provided by different companies, particularly in salary, opportunities, and clarity of the responsibilities in the job roles that apprentices will be committing to as they also complete degree study. As well as contributing to the discussions around social mobility and metaskills, we have prepared the ground for further studies to look at standardisation of apprenticeship programs, studies that explore the wider selection aspect of degree apprenticeships, and studies that look at the alignment of employer roles and universities.

References

Ahmed, F., Campbell, P., Beg, A., and Captretz, L. F. (2011). What Soft Skills Software Architect Should Have? A Reflection from Software Industry. *International Conference on Computer Communication and Management, 5*, 565–569.

Barr, M. and Parkinson, J. (2019). Developing a Work-based Software Engineering Degree in Collaboration with Industry. *Proceedings of UK & Ireland Computing Education Research Conference (UKICER), September 5–6, 2019, Canterbury, UK*. New York: ACM. https://doi.org/10.1145/3351287.3351292

Behpour, S., Hawamdeh, S., and Gourarzi, A. (2019). Employer's Perspective on Data Science; Analysis of Job Requirement & Course Description. *ALISE 2019 Proceedings*, 177–182.

Belhe, H. (2020). Students' and graduates' employability: A framework to classify and measure employability gain. *Policy Reviews in Higher Education*, 4(1), 105–130. doi:10.1080/23322969.2020.1712662

Bravenboer, D. (2016). Why co-design and delivery is "a no brainer" for higher and degree apprenticeship policy. *Higher Education, Skills and Work-Based Learning, 6*(4), 384–400. https://doi.org/10.1108/HESWBL-06-2016-0038

Burke, C., Scurry, T. Blenkinsopp, J., and Graley, K. (2017). Critical Perspectives on Graduate Employability. In M. Tomlinson and L. Holmes (eds.) *Graduate Employability in Context. Theory, Research and Debate*. London: Palgrave Macmillan UK.

Centre for Work-Based Learning (2018). *Skills 4.0 A skills model to drive Scotland's future*. Skills Development Scotland https://www.centreforworkbasedlearning.co.uk/media/1542/skills-40_a-skills-model.pdf

Dawson, S., and Osborne, A. (2020). Re-shaping Built Environment Higher Education: The Impact of Degree Apprenticeships in England. *International Journal of Construction Education and Research*, 16(2), 102–116. https://doi.org/10.1080/15578771.2019.1668888

Drewery, D. W., Pretti, T. J., and Church, D. (2020). Signaling 'student-oriented' job opportunities enhances job attractiveness in work-integrated learning programs. *Higher Education Research & Development*, *0*(0), 1–14. https://doi.org/10.1080/07294360.2020.1857346

Florea, R., and Stray, V. (2019). The skills that employers look for in software testers. *Software Quality Journal*, *27*(4), 1449–1479. https://doi.org/10.1007/s11219-019-09462-5

Gambin, L., and Hogarth, T. (2016). Counting the cost, reconciling the benefits: understanding employer investment in Higher Apprenticeships in accounting. *Accounting Education*, *25*(5), 502–518. https://doi.org/10.1080/09639284.2016.1218779

Harper, R. (2012). The collection and analysis of job advertisements: A review of research methodology. *Library and Information Research*, *36*(112), 29–54. https://doi.org/10.29173/lirg499

Hoskins, K. and Ilie, S. (2017). Widening Participation to Underrepresented and Disadvantaged Students: Social Identity and the Barriers to Higher Education Access in England. In M. Shah and G. Whiteford (Eds.) *Bridges, Pathways and Transitions: International Innovations in Widening Participation*. Cambridge, UK: Chandos. https://learning.oreilly.com/library/view/bridges-pathways-and/9780081019221/xhtml/chp006.xhtml#st0030

Hubble, S. and Bolton, P. (2019). *Degree Apprenticeships*. House of Commons briefing paper

number 8741, 18 December 2019. https://researchbriefings.files.parliament.uk/documents/CBP-8741/CBP-8741.pdf

Incomes Data Research. (2019). *Pay for degree-apprentices rises more rapidly than that for traditional graduates*. https://www.incomesdataresearch.co.uk/resources/press-releases/pay-for-degree-apprentices-rises-more-rapidly-than-that-for-traditional-graduates-press

Institute for Apprenticeships (2019). *Apprenticeship standard:Digital and technology solutions professional (integrated degree).* https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-(integrated-degree)-v1-1

Institute of Student Employers. (2020). *Student development survey 2020: Supporting the learning and development of entry-level hires*. London: Institute of Student Employers. https://ise.org.uk/page/ISEPublications

Julien, H. (2008). Content Analysis. In L. Given (Ed.), *The SAGE Encyclopedia of Qualitative Research Methods*. SAGE Publications, Inc. https://doi.org/10.4135/9781412963909.n65

Lester, S. (2020). Creating conditions for sustainable degree apprenticeships in England. Higher Education, Skills and Work-Based Learning, 10(5), 701–714. https://doi.org/10.1108/HESWBL-04-2020-0062

Lester, S., Bravenboer, D., and Webb, N. (2016). *Work-integrated degrees: Context, engagement, practice and quality A literature review for QAA.*

Lillis, F., and Bravenboer, D. W. (2020). The best practice in work-integrated pedagogy for degree apprenticeships in a post-viral future. *Higher Education, Skills and Work-Based Learning*, *10*(5), 727–739. https://doi.org/10.1108/HESWBL-04-2020-0071

Mcgill, M. (2009). Weighted game developer qualifications for consideration in curriculum development. *SIGCSE Bulletin Inroads*, *41*(1), 347–351. https://doi.org/10.1145/1539024.1508991

Parker, A., and Brown, I. (2019). Skills Requirements for Cyber Security Professionals: A Content Analysis of Job Descriptions in South Africa. In *The Practical Handbook of Internet Computing* (pp. 176–192). Springer International Publishing. https://doi.org/10.1007/978-3-030-11407-7_13

Payne, G. and Payne, J. (2004). *Key concepts in social research.* Sage Publications, Inc. https://doi.org/ 10.4135/9781849209397.n10

Pitt, R., and Mewburn, I. (2016). Academic superheroes? A critical analysis of academic job descriptions. *Journal of Higher Education Policy and Management*, *38*(1), 88–101. https://doi.org/10.1080/1360080X.2015.1126896

Powell, A. (2019). *Apprenticeships and skills policy in England*. House of Commons Briefing Paper CBP 03052, 7 January. https://researchbriefings.files.parliament.uk/documents/SN03052/SN03052.pdf

Powell, P. and Walsh, A. (2018). Whose curriculum is it anyway? Stakeholder salience in the context of Degree Apprenticeships. Higher Education Quarterly, 72(2), 90-106. DOI: 10.1111/hequ.12149

QAA (2019). *Characteristics Statement Higher Education in Apprenticeships*. Gloucester, UK: The Quality Assurance Agency https://www.qaa.ac.uk/docs/qaa/quality-code/characteristics-statement-apprenticeships.pdf

Rowe, L., Perrin, D., and Wall, T. (2016). The Chartered Manager Degree Apprenticeship: trials and tribulations. *Higher Education, Skills and Work-Based Learning*, *6*(4), 357–369.

https://doi.org/10.1108/HESWBL-05-2016-0034

SDS. (2016). *Graduate Level Apprenticeships at SCQF level 10: Technical Specification*. Skills Development Scotland, Glasgow, UK.

SDS. (2019). *Graduate Apprenticeships Early Activity and Progress*. Skills Development Scotland, Glasgow, UK. http://www.skillsdevelopmentscotland.co.uk/media/45882/ga-report-2019.pdf

SDS. (2020). *Graduate Apprenticeships: A brand new way to work, learn and earn*. Skills Development Scotland. https://www.apprenticeships.scot/become-an-apprentice/graduate-apprenticeships/

Shadbolt, N. (2016). *Shadbolt Review of Computer Sciences Degree Accreditation and Graduate Employability*. London: BIS. https://www.gov.uk/government/publications/computer-science-degree-accreditation-and-graduate-employability-shadbolt-review

Smith, S., Caddell, M., Taylor-Smith, E., Smith, CF., and Varey, A. (2020). Degree apprenticeships - a win-win model? A comparison of policy aims with the expectations and experiences of apprentices, *Journal of Vocational Education & Training*. https://doi.org/10.1080/13636820.2020.1744690

Somerville, D., Cutts, Q., Barr, M., and Parkinson, J. (2020). Addressing mixed levels of prior knowledge by individualising learning pathways in a Degree Apprenticeship Summer School. *Proceedings of the 4th Conference on Computing Education Practice* 2020, 1–5. https://doi.org/10.1145/3372356.3372370

Taylor-Smith, E., Smith, S., Fabian, K., Berg, T., Meharg, D., and Varey, A. (2019). Bridging the Digital Skills Gap: Are computing degree apprenticeships the answer? In *Proceedings of the 24th Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE'19)* https://doi.org/10.1145/3304221.3319744

Tomlinson, M., and Anderson, V. (2020). Employers and graduates: the mediating role of signals and capitals. *Journal of Higher Education Policy and Management*, 1-16. DOI:10.1080/1360080X.2020.1833126

UKCES (2015). *Sector insights: skills and performance challenges in the digital and creative sector.* UK Commission for Employment and Skills (UKCES) https://www.gov.uk/government/publications/sector-insights-skills-and-performance-challenges-in-the-digital-and-creative-sector

Universities UK (2017). *Degree Apprenticeships: Realising Opportunities*. UUK and HEFCE. https://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2017/degree-apprenticeships-realising-opportunities.pdf

Verma, A., Yurov, K. M., Lane, P. L., and Yurova, Y. V. (2019). An investigation of skill requirements for business and data analytics positions: A content analysis of job advertisements. *Journal of Education for Business*, *94*(4), 243–250. https://doi.org/10.1080/08832323.2018.1520685

Wakeham, W. (2016). *Wakeham Review of STEM Degree Provision and Graduate Employability*. London: BIS. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/518582/ind-16-6-wakeham-review-stem-graduate-employability.pdf

Appendix A – Examples of tasks

Task Categories	Excerpts of tasks from job adverts
Business Skills	• Business skills such as preparing and managing your own specific projects within the portfolio as well as managing key stakeholders. (Advert 020) • You will work with other departments within the company to enhance your product knowledge. (Advert 039) • You will analyse and translate the needs from the business into information and technical requirements (Advert 021)
Project and delivery management	• Dealing with multiple tasks and projects. (Advert 200) • [You will be involved in] the development, implementation and appraisal of environmental policy and technical solutions (Advert 184) • You will help take the software through 'Proof of Concept' (PoC) to test how viable it is and whether it can be implemented technically. (Advert 278)
Develop interpersonal skills	• Liaise with clients to provide advice and answer queries (Advert 323) • Establish, build and grow relationships with internal FDM staff through effective communication, consistency and the provision of a professional service (Advert 373) • [You will] interact with laboratory scientists, software developers and quality professionals to deliver projects as a team (Advert 391)
Cyber Security	• Helping clients use the latest technology to solve complex issues like fraud (Advert 003) • Monitor the company's networks for malicious activity using Security processes. (Advert 120) • Assigning appropriate user access and resources (Advert 170)
Networks	• Assist in configuring and set up of new server systems, required internally for company activities (Advert 119) • planning a project to replace a client's server and network infrastructure (Advert 158) • Production of network design specifications, configuration of managed switches, factory testing, site testing and site based commissioning (Advert 190)
Software development	• Designing new software products (Advert 015) • Design & develop web interfaces for relational database technologies (Advert 069)

	• Participate in the design of software systems - UX is a key component of this Create applications using html, css, javascript, php, c# and sql (Advert 167)
Support and Debugging	• To assist in the maintenance and development of software for the company's products (Advert 165) • Maintaining and improving the performance of existing software (Advert 183) • Maintenance of documentation associated with user manuals, installation guides etc. (Advert 207)
Testing	• Review code and test applications (Advert 247) • Conducting functional and performance testing (Advert 332) • Ensure proper compliance and testing of applications (Advert 336)
Data analysis	• Look to find information in diverse data sets to address complex problems and learn skills in computer science, statistics, data analysis and much more (Advert 314) • Manipulation, visualisation and analysis of diverse data sets Integration of data from public and private source (Advert 330) • use data to craft views that help us make decisions (Advert 348)
Data management	• Perform database administration tasks and is cognisant of the key concepts of data quality and data security. (Advert 324) • Manage data and report on conclusions to inform business decision making (Advert 298) • Curating databases (Advert 168)