Bridging the Digital Skills Gap*

Are computing degree apprenticeships the answer?

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ABSTRACT

This paper describes a study investigating whether apprenticeship computing degrees in Scotland are attracting additional entrants who will become IT professionals and fill a skills need. Government policy reports, from around the world, set out plans to address computing skills shortages by introducing additional education or training programmes [23]. In the UK, this is put forward as a key goal of the new higher level apprenticeships, including Graduate Apprenticeships in Scotland and Degree Apprenticeships in the rest of the UK. These are promoted as bridging the skills gap by involving employers in curriculum design and widening access to people who would not want to study towards a traditional degree, because of the financial burden or time out of employment. New graduate apprentices at three Scottish universities were encouraged to complete a short survey, asking about their route into the degree, including their aspirations, motivations, and previous experience. Most respondents had begun an IT career before they started the apprenticeship and were upskilling and gaining an internationally recognised qualification. A third could be considered new to IT, including those coming straight from school and those moving into IT mid-career. The apprentices' primary motivation was to gain skills. They chose the apprenticeship, rather than a traditional degree, because of the integration of work experience, followed by financial reasons: graduate apprentices earn salaries and can avoid student debt. These apprenticeships create a new route to a computing degree-level qualification. We consider their potential in addressing digital skills shortages.

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1. Introduction

The digital skills discourse identifies a shortage of people with appropriate digital skills, mostly evidenced through consulting employers [6, 30, 25, 34], but also via labour market analytics [21]. The digital skills gap, explored in more detail below, is described in terms of both a deficit in the number of digitally-skilled workers and a lack of appropriate skills in those who are currently employed, including computing graduates entering the workplace [34]. Governments across the world are concerned [23]. European forecasts based on the number of students currently studying computing subjects in Higher Education Institutions (HEIs) indicate that a step-change is needed to fill vacancies in "top bottleneck occupations", which require professional IT skills [31]. In the UK, employers have repeatedly expressed their dissatisfaction with the skills of university graduates; specifically, they expect computer science graduates to have good computer science skills (such as programming languages and approaches), soft skills (including communication) and project management skills [30]. In parallel, the Wakeham review notes evidence that "employers are tending to devote fewer resources to 'on the job' training, increasingly relying on 'oven-ready' graduates to hit the ground running" [34, p18-19]. While acknowledging the range of digital skills needed by employees at all levels and in areas of life beyond the work context, here we are concerned, like Shadbolt and Wakeham, with the skills that computing graduates need for sustainable and successful careers.

To this end, the UK and Scottish governments updated models of apprenticeships to extend their coverage into higher education [14, 26]. Employers would decide the skills content of these higher level apprenticeships [11, 12, 22] and the apprentices would be paid employees. The scheme, including payment of university tuition fees, would be funded through the new apprenticeship levy, where, since April 2017, all large employers contribute 0.5% of their salary costs [20].

This study investigates the potential of Graduate Apprenticeships (GAs) in computing in Scotland to help to close the digital skills gap, bringing new talent into the IT profession and ensuring graduates are equipped with the necessary skills for sustainable employment. Graduate apprentices studying one of the four computing apprenticeship degrees at three universities were surveyed during their first trimester. Their responses to questions about their aspirations and motivations for choosing the programme and about their previous relevant experience are analysed to identify who is taking up these early apprenticeship opportunities. Are the apprentices new talent, attracted by the format and finance? Or are they students who were planning to study computing at university but have opted for this route? The apprentices' journey into their apprenticeship degrees also provides insights into the likely future take-up of the degrees. This study is an initial exploration into the extent to which higher apprenticeships might help to close the digital skills gap.

2. The digital skills gap

As expressed by industry and recruiters, the digital skills shortage or gap is not a new problem, but an issue that governments are focusing on, in order to address the changing industrial climate, including the threats and opportunities of automation, digitalisation, and big data [23, 33]. In the context of apprenticeships and higher education, the gap is discussed in terms of the skills needed in employment as digital technologies and data become increasingly central to more processes and industry evolves into new forms [33], sometimes described as Industry 4.0 [5]. This development requires technical skills, such as programming, managing networks and databases, and working with large datasets, plus soft skills, such as communication and project management [15, 30]. As this context is also characterised by continuous change, a third set of skills is necessary, often conceptualised as "learning to learn" [e.g., 9]. These skills are also discussed in terms of meta-skills [e.g., 5], higher-order skills which support other skills. The first two sets of skills (technical and soft skills) are those identified by employers as essential (and sometimes lacking in graduates) in their responses to government consultations [cf. 30, 34]. The third set of skills are discussed more by academics and professional bodies, especially in the context of work-based learning and the need for professionals to continue to develop their learning and skills after finishing courses [e.g., 8, 9]. This is essential in IT, where *specific* knowledge and skills learned at university are perceived by employers to go quickly "out of date" [1, 5]. The annual Scottish Technology Insights Survey consistently shows software and web application development skills in highest demand [e.g., 25], however the specific programming languages cited in recent reports are multiple and varying. Between 2010 and 2017, nine different programming languages are mentioned; five are mentioned only once. As such, it is not in universities' or graduates' best interests to structure a four year degree course around building very specific skills based on the shifting sands of industry demand.

Nonetheless, apprenticeship policy aims to address the digital skills shortage by increasing the numbers gaining digital skills; and increasing the numbers of those with higher-level digital skills to meet the evolving contexts of technology in their roles. Employers are given a central role in identifying the necessary skills, acknowledging their in situ need and awareness, as well as their previous dissatisfaction with the job-readiness of computing graduates. Universities need to provide the fundamental knowledge underpinning skills so that their graduates continue to seek out, contextualise, and apply new knowledge throughout their careers [3, 14].

Collaborating with employers could also help universities to address retention problems in Computing. Figures from HESA (the UK government's Higher Education Statistics Agency) indicate that 10.5% of UK-domiciled undergraduates who started their degrees in 2015/16 at UK universities have left higher education without achieving any awards, compared to 6.4% across all subjects [10]. Various studies have focused on computing students' conceptualisation of computing/IT at university as an indication of their likely progression [e.g., 2, 13, 18, 19]. A narrow focus on programming, within the human-computer dyad, suggests a difficult course and unattractive career; whereas students who see programming as creative, collaborative, and integrated with the outside world, enjoy the associated hard work. Kinnunen et al. specifically note the disparity between students' expectations of their course (mostly programming) and their career aspirations, including managing projects and companies, but also contributing to society and making a difference [13]. Dziallas and Fincher [7], asking computing graduates to look back over their degrees, which included a year in industry, found that their experience in the workplace could transform their understanding of themselves as programmers and increase their engagement in the final year of their course. Based in the workplace, apprentices have a major input into their understanding of computing as a practice and career, potentially providing the contextual and social elements which give their studies meaning [18].

To address the perceived disconnect between computing studied at university and digital skills needed by industry, as well as the need for more computing graduates, apprenticeships focusing on digital skills have been prioritised in Scotland [28]. The first graduate apprenticeships were established in 2017 as collaborations between employers and HEIs, facilitated by Skills Development Scotland, the executive public body of the Scottish Government tasked with managing Graduate Apprenticeships.

3. Graduate Apprenticeships

Ryan and Unwin [24] define contemporary apprenticeships as “a structured programme of vocational preparation, sponsored by an employer, juxtaposing part-time education with on-the-job training and work experience” (p. 100). In 2017, Scotland’s first computing graduate apprentices began their degrees, including BScs in Software Development, Cyber Security, and Information Technology Management for Business. Data Science apprenticeships became available in 2018.

Graduate Apprenticeships are degree programmes in which the students are in full-time, salaried employment, while completing degree credits. The curricula are developed in each university running apprenticeship degrees to satisfy frameworks approved by industry-led technical expert groups. Undergraduate degrees are completed over four years, the same as for a traditional full-time degree in Scotland. Models vary between courses; for example, apprentices may study on campus one day per week, or in blocks, or online, combined with work-based learning, throughout the year. Their fees are paid, via Skills Development Scotland, from the UK Apprenticeship Levy and, initially, the European Social Fund. The degrees parallel Degree Apprenticeships in England, though there are important national differences in implementation.

The policy papers and promotional material around the Graduate Apprenticeships highlight their potential to address Scotland’s digital skills shortage [e.g., 26, 28]. This also enables employers to frame their role in employing apprentices or supporting staff to study degrees as contributions to the national good, i.e. by helping to address the digital skills gap [e.g., 4, 16], rather than increasing their organisation’s skill base or recouping their contributions to the Apprenticeship Levy. This study focuses on the individual level of the digital skills gap [23] by surveying apprentices. We explore their experience of moving into or forward in IT professional roles as they embark on their apprenticeships. Are there differences in the demographics or ambitions of apprentices according to whether they are upskilling or new to IT? Are the apprenticeships supporting the expansion of the pool of digitally-skilled graduates or just supplying a new route? The following sections describe the survey of new apprentices and contextualise findings according to the policy aims to address the digital skills gap.

4. Methodology

Graduate apprentices at three Scottish universities were invited to complete a short survey during their first trimester. New apprentices at one university completed the survey on paper in both 2017 and 2018; apprentices at the other two universities completed surveys online in 2018. A dataset was created from these surveys, using only responses from apprentices studying computing degrees: i.e., Cyber Security, Data Science, Information Technology Management for Business, or Software Development. The aim of the data analysis was to identify the apprentices’ paths into their degree programmes, especially the extent to which they were moving into IT careers or moving forward within established IT careers.

5. Findings from the survey

5.1 Apprentices’ backgrounds

The survey aimed to build a picture of the new graduate apprentices. Who was choosing this degree? Who was being put forward by their employer or recruited into it? We are particularly interested in whether new people are being attracted into IT careers by this innovative degree.

To discover more about routes in to these new apprenticeships, we analysed the survey responses to identify whether the apprentices were *new recruits into IT* (n=29) or *upskillers*, already employed in IT roles (n=53). New recruits were mostly recruited, by their employer, directly into their role as graduate apprentices (without previous IT qualifications or related experience of higher education); two were already working for their employer, but in a non-IT role (such as electrical engineer). Our upskillers were either already working for their employer when they started the Graduate Apprenticeship, in a more or less skilled *IT role* (e.g., testing, helpdesk, project management, developer) or were recruited into the Graduate Apprenticeship but had previous qualifications or experience in IT, such as a Modern Apprenticeship or previously starting a computing degree. These two groups were then compared, using survey data about their demographics and skills preferences.

Table 1: Survey respondents’ demographic data

Demographic Data (N=82)		Count (Col %)	Upskillers (Col %)	New to IT (Col %)
Gender	Female	17 (21%)	12 (23%)	5 (17%)
	Male	63 (77%)	40 (75%)	23 (79%)
	NS	2 (2%)	1 (2%)	1 (3%)
Age	25 below	64 (78%)	36 (68%)	28 (97%)
	26 above	18 (22%)	17 (32%)	1 (3%)
Ethnicity	White UK	73 (89%)	44 (83%)	29 (100%)
	Other	9 (11%)	9 (17%)	0 (0%)
First in the family to uni	Yes	31 (38%)	22 (42%)	9 (31%)
	No	48 (59%)	30 (57%)	18 (62%)
	NS*	3 (4%)	1 (2%)	2 (7%)
SIMD**	20-40	15 (18%)	10 (19%)	5 (17%)
	40+	38 (46%)	20 (38%)	18 (62%)
	NS*	29 (35%)	23 (43%)	6 (21%)
Recruitment	Into GA	37 (45%)	9 (17%)	27 (93%)
	Existing employment	45 (55%)	43 (83%)	2 (7%)
		N = 82	n = 53	n = 29

*NS = not specified

**Scottish index of Multiple Deprivation

Table 1 summarises the characteristics of these two groups.The Scottish Index of Multiple Deprivation (SIMD) is used as an indication of the apprentices' socio-economic backgrounds. SIMD brings together a variety of indices that describe deprivation related to health, education, crime, and housing. SIMD categories are based on postcode data, with 20-40 indicating the two most deprived quintiles [27]. These figures provide a useful overview, but should be approached with caution as there are likely to be mismatches between people and their current residential location. Postcodes were not collected in the 2017 survey, hence the relatively high proportion of *Not Specified*). Apprentices were also asked whether they were the first in their family to attend university.

From the survey data, it appears employers are enabling existing employees to take advantage of the apprenticeship to gain a recognised award: 55% of respondents were with their current employer when they started the Graduate Apprenticeship, while 45% were recruited specifically as graduate apprentices. However, these two categories contain both upskillers and new recruits to IT: nine people who were recruited by their employer to do the Graduate Apprenticeship had previous IT experience (upskillers) and two people who were with their employer before the Graduate Apprenticeship were in non-IT roles (new to IT), while 83% of upskillers were with their current employer before starting the apprenticeship (Table 1).

The computing discipline in the UK is not gender-balanced: only 17% of on-campus students identify as female [HESA https://www.hesa.ac.uk/data-and-analysis/students/whos-in-he]. The gender balance of our new to IT group, reflects this imbalance at 17%, however 23% of our upskillers are female. This could indicate that women move into the IT profession at a later stage on their careers, which could be a useful steer for recruiters and for universities' marketing. The ethnicity data shows a worrying lack of diversity, especially as 7/9 of the *other* category are white non-UK—nearly 99% white, compared to Scotland's most recent (2011) census figure of 96% white [https://www.scotlandscensus.gov.uk/].

Not surprisingly, only one of our new entrants to IT is over 26, versus 32% of our upskillers, a statistically significant difference in proportion, as assessed by Fisher's exact test ($p<.001$) The data also shows that employers have chosen relatively young candidates to fill newly created apprenticeship roles. If we break down the age data according to whether the apprentices were recruited directly into the Graduate Apprenticeship, we see that only one of the directly-recruited apprentices is over 26 (under 3%), whereas 36% of those already employed are over 26. A further exploration of recruitment decisions and promotion of the apprenticeship opportunity would uncover whether this was intentional (and why). Were older potential candidates less likely to apply or less likely to be successful? For example, the salary for new Graduate Apprentices may be more attractive to school-leavers who are living with their parents or in student accommodation than to those living independently.

Apprentices with prior IT experience are more likely to be the first in their family to attend university (41% to 31%) and slightly more likely to come from an area of multiple deprivation (19% to 17%) than those entering IT. These *upskillers*' profiles suggest that, if successful, the IT industry will enjoy an increase in both number and diversity of highly qualified IT workers. Certainly, through completing the degree, the upskillers will acquire more widely recognised qualifications.

5.2 Apprentices' skills and motivations

Participants were asked about the skills they had gained prior to starting the apprenticeship. The free text responses were coded into the three areas: subject knowledge, project management, and soft skills (Table 2). These were the areas identified in the Shadbolt report [30, p.53].

Table 2: Existing skills

Relevant Skills	Upskillers (Row %)	New to IT (Row %)	Total
Subject Knowledge	36 (67%)	18 (33%)	54
Soft Skills	23 (62%)	14 (38%)	37
Project Management	8 (62%)	5 (38%)	13

Of the valid responses, 67% (54) declared some working knowledge of computing, 46% (37) identified having soft skills like problem solving and communication skills, and 16% (13) have skills in project management. As may be expected, a breakdown of these numbers indicates that those with prior experience in IT identified a wider range of relevant skills than the new recruits. Further research would be needed to identify the extent of these existing skills, especially compared to students starting on-campus undergraduate degrees. Understanding the apprentices' diverse baselines of experience is necessary for universities to pitch teaching at the appropriate level.

Table 3: Importance of new skills

Skills	N	Mean	Std. Deviation
(1) Technical skills I can apply at work	58	4.72	0.62
(2) Using technologies (e.g. Using specific business tools or software)	58	4.09	0.94
(3) Personal development (problem solving, critical thinking, self-management etc.)	58	4.02	1.03
(4) Theoretical knowledge (e.g. understanding relevant theory and models)	57	3.89	1.18
(5) Professional skills (e.g. Career development, understanding business processes)	58	3.84	1.25
(6) Management and project management.	58	3.33	1.55
(7) Interpersonal skills (e.g. working as a team, communications)	58	3.28	1.17
(8) Writing (e.g. technical writing, report writing)	55	2.71	1.46

Participants were asked about the skills they wanted to develop on the course. In 2017, this was a free-text option. Based on the responses gathered in 2017, the question was developed, specifying eight skills and asking apprentices to rate them on a scale of 0 to 5, where a score of 5 reflects high importance, and 0 low importance. Thus Table 3 contains responses from 2018 only. The ratings show that, for most apprentices, *technical skills they can apply at work* are the most relevant/important skills followed by the ability to *use specific tools and software* (mean = 4.09, sd = .94) and *soft skills related to personal development* (mean = 4.02, sd = 1.03). Apprentices, irrespective of their previous background, were most interested in learning skills that could be applied at work, which aligns with employers' requests for workers with immediately relevant skills [34].

An independent t-test of the skills-rating from those new into IT versus the upskillers (see Table 4) showed that those with previous IT experience scored *theoretical knowledge* and *writing skills* slightly higher than those new to the IT (with small effect sizes of .255 and .433). The skills categories *technical skills, using technologies, interpersonal skills* and *professional skills*, were scored slightly higher by those new into IT (effect sizes ranging between =.201 to .358). None of these differences were statistically significant. It is difficult to say whether this is due to the small sample size or indicates homogeneity between the groups. The exploration of apprentices' current and desired skills (including any meaningful difference according to their background) is important in creating flexible learning paths, one of the tenets of the Graduate Apprenticeship specification [29]. For example, skilled and experienced apprentices could benefit from the creation of different degree entry points, including entry to a later stage of the course when topics contain more theoretical concepts and less direct application of skills.

Table 4: Importance of new skills (Prior experience of IT, New to IT)

Skills	New to IT	N	Mean	SD	p-value	Effect Size
Technical skills	No	32	4.66	0.75	.329	0.25
	Yes	26	4.81	0.40		
Using technologies	No	32	4.00	0.95	.444	0.20
	Yes	26	4.19	0.94		
Personal Development	No	32	4.03	0.82	.910	0.03
	Yes	26	4.00	1.26		
Theoretical knowledge	No	31	4.03	1.14	.339	0.26
	Yes	26	3.73	1.22		
Professional Skills	No	32	3.72	1.30	.400	0.22
	Yes	26	4.00	1.20		
Project Management	No	32	3.34	1.60	.931	0.02
	Yes	26	3.31	1.52		
Interpersonal Skills	No	32	3.09	1.25	.190	0.36
	Yes	26	3.50	1.03		
Writing Skills	No	32	2.97	1.49	.121	0.43
	Yes	23	2.35	1.37		

In 2018 the apprentices were asked: "Were you considering other options? (e.g., part-time degree, GA in another subject, certificates)." Table 5 summarises the free text responses according to the two groups, indicating that those who were new to IT were much more likely to be considering studying a traditional degree (50%); About a quarter of the upskillers were also considering traditional study (27%), including part-time study options (12%). These alternative plans reflect the ages and employment status of the two groups: 58% of the new to IT group had left school in the last 18 months, compared to 9% of the Upskillers. This indicates that up to half of the new to IT group were not brought to IT by the apprenticeship opportunity, but were following their plans, established at school, to study computing.

Table 5: Other options

	Upskillers (n=34)	New to IT (n=26)
Full-time degree	5 (15%)	13 (50%)
Part-time degree/ other study	4 (12%)	0 (0%)
Another GA	3 (9%)	6 (23%)

However, responses to the question "Why did you choose this apprenticeship degree, rather than a traditional full-time degree?" indicate that many apprentices did not consider themselves in a position to take on a traditional degree. Common themes were identified in the free text responses to this question and the number of respondents mentioning each of six themes was counted (across all the respondents). The most common reason given for choosing the apprenticeship route was the integration with work experience: 41% (34) of respondents mentioned this. For example: "I like working and gaining experience while studying." The second most important factor was financial reasons, with 33% (27) of responses mentioning this. While Scottish-domiciled students' fees are paid by the government, they generally need to take on considerable loans and/or paid work to cover their living expenses, whereas graduate apprentices are paid a salary. Some apprentices felt they could not have afforded to do a traditional degree: for example, "I could not really afford to go to university and did not want to get in debt with student loans." As noted above, over half the apprentices were already with their employer when they started the degree; keeping their job was a solid reason to choose the apprenticeship: 22% (18) mentioned this; for example, "Mostly because I am already in my Dream Role but would like to further my career whilst working".

6. Discussion

The aims of the new degree apprenticeships in computing were to increase the number of IT workers with computing degrees and ensure that these computing graduates' skills matched the industry's needs (indicated by the employers' role in designing the degree frameworks). Our survey data found evidence of both of these aims being shared by the apprentices themselves: when asked about gaining skills, the apprentices rated all the suggested skills categories as relatively important and the skills most explicitly linked with work (in their given descriptions) as most important. The number of highly–skilled IT professionals is on the way to being increased on two fronts: apprentices new to IT and people with IT careers gaining higher level skills.

The GA frameworks have been approved by an industry-focused technical expert group. The framework development approach to ensure relevance of degree courses has been used elsewhere, e.g., through publication of specifications and accreditation activity by the ACM and the British Computer Society (BCS). None of these curriculum specifications (ACM, BCS or GA) list current products, such as specific programming languages, database systems, or cloud architectures. And yet, much of the criticism of computing graduates' skills centres on a lack of a specific products and languages, with employers each requesting their latest project toolsets, as evidenced by ScotlandIS [25]. The pragmatic framework approach of the apprenticeship degrees collates employers' needs. Combined with close involvement in the workplace delivery of these degrees, this will hopefully lead to a better shared understanding of the graduate profile—that graduates will know fundamental concepts, know specific skills, and know how to learn and apply new skills, throughout their careers. These apprenticeship degrees are an opportunity to re-frame the relationships between universities and employers and work together on skills development, rather than demand that graduates are proficient in the latest technologies, as industry surveys [e.g., 25] consistently show these to be short-lived.

As the funding is limited, these apprenticeship degrees will not entirely replace traditional computer science degrees. To develop all their computing courses, universities need to continue working together with bodies such as the BCS and ACM who continually refresh their curricular frameworks. However, at present, BCS accredit degree apprenticeships only to *Registered IT Technician*, rather than full chartered professional level [BCS https://www.bcs.org/media/1209/accreditation-guidelines.pdf]. For the Graduate Apprenticeships, the survey data suggests that apprentices have a good sense of what they want from their degree; plus, ongoing negotiation of workplace learning can be used to ensure university computing curricula increasingly align with local industry needs.

In terms of increasing the number of skilled IT workers, the survey provided some evidence of apprentices being drawn from currently under-represented groups, including a slightly higher percentage of women studying computing than for the three universities' on-campus courses: for example, 21% of our survey respondents identify as female, compared to 19% of undergraduate computing students in one of the universities and 12% in another. The current ethnicity figures are worrying, although the Scottish context should be noted: for example, in one of the survey universities, 92% of the undergraduate computing students identify as white. The collaborations may provide opportunities for employers and universities to share their approaches to increasing diversity and social mobility [e.g. see 17]. As apprentices' fees are paid throughout their course and they receive salary, they can avoid student debt and this may help to widen access to those from more debt-averse backgrounds. Survey respondents included people from areas of multiple deprivation and people who were the first in their family to attend university, though these proportions are still some way off reflecting the population.

While the majority of apprentices had some experience of the IT industry or computing higher education, the survey revealed how the number of new recruits jumped, as a proportion, between the 2017 and 2018 cohorts: in 2017, 17% of respondents had been recruited for the Graduate Apprenticeship; in 2018, 53% were recruited straight in. This is probably due to employers having a greater understanding of the degrees in their second year and more time available for employers to recruit and universities to market the degrees. This jump is evident in the data for the one university which surveyed apprentices in both years, so it is not due to a difference in marketing between the universities. However, the alternative plans of the new to IT group suggest that half would have studied computing at university anyway if the apprenticeship had not been available to them. In parallel, NCUB [17] try to uncover whether organisations employing graduate and degree apprentices are increasing their employees overall or replacing graduate recruitment with the apprenticeships. In NCUB's study of twelve employers, all twelve were planning to increase both the number of degree apprentices and the ratio of apprentices to graduate recruits.

Whether the Graduate Apprenticeship provides new pathways into the IT profession or new opportunities to gain skills (and internationally recognised qualifications) for current employees, it is a major investment in people that will benefit the IT industry. It has been suggested that the intensity of graduate and degree apprenticeships may make them more suitable for people with some experience of the IT profession, rather than young people straight from school who are likely to be less certain about their career goals [32]. Further work is required to follow these new apprentices through to degree completion, to explore the nature of work-based learning as the course is delivered and seek confirmation that the digital skills gap is being addressed in terms of quality. Repeating the survey in the coming years and involving more universities will reveal the extent to which the skills gap is being addressed in terms of quantity and diversity.

7. Conclusion

Degree apprenticeships in computing subjects present a new opportunity for universities to work with funders and employers to increase the numbers of graduates with the right skills. The new Apprenticeship Levy, funding these endeavors, enables new courses, with apprentices both embedded in the workplace and attending university. We report on an early study into the prior backgrounds and ambitions of the first cohorts of computing apprentices in three Scottish universities. The combined responses indicate that initial employer approaches to recruiting staff to these apprenticeships constitute a mix of direct recruitment of new staff and allocating places to existing staff. There is some indication from the survey data that the proportion of new recruits to upskilling may change over time, reflecting NCUB's account [17] of employers developing their understanding of how the apprenticeships fit in with their recruitment and training processes. Early indications about the opportunity to bridge the skills gap by this means look positive: new recruits will gain computing skills; existing staff will gain advanced skills and a recognised qualification. Computing apprenticeships look like they might be part of the answer, though limited by the restriction on funded apprenticeship places. It remains to be seen how this limit, or the intense nature of the apprenticeships, will impact on the diversity of people gaining computing degrees this way.

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