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Who's coding? An analysis of UK bootcamp experiences and outcomes

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Abstract

Bootcamps are intensive training programs that aim to turn adults with little to no experience into employable software developers and data scientists, typically in 3–4 months. The bootcamp model has been highly touted in the UK, with significant government investment. However, it is unclear whether UK coding and data science bootcamps make good on their key claims, particularly around employment and salaries. There is a dearth of evidence on UK bootcamp attendees and their motivations, experiences and outcomes. This study begins to address this research gap, identifying who goes to coding & data science bootcamps in the UK, their motivations, and the key factors that impact bootcamp students' experiences and outcomes. Our research demonstrates that there are several demographic factors that impact bootcamp experience and success in the UK, including age, disability, immigration history, caring responsibilities, and financial circumstances. Overall, coding and data science bootcamps tend to most significantly benefit younger, non-disabled, native British people from financially stable backgrounds who do not have caring responsibilities. These findings contradict claims that bootcamps offer an accessible gateway for marginalised groups looking to obtain coveted, well-remunerated roles in the UK digital and data industries.

Keywords

Coding bootcamp, digital skills, data science, UK, inequalities, computing education

Introduction

For over a decade, learning to code has been positioned as a 'future-proof' solution (Mulas et al., 2017) for a series of entrenched issues, including digital skills shortages, inequality in the tech industries, and socioeconomic mobility (Francis, 2019; Hammond et al., 2018; Miltner, 2019; Williamson, 2016). In the UK, the benefits of learning to code have been regularly touted in the press (e.g., Woollacott, 2024) and policy documents (Department of Science, Innovation and Technology and Donelan, 2024) since the mid-2010s (Williamson, 2016). In response to this discourse, a highly profitable industry of short-term web development, software engineering, and data science courses, more popularly known as 'coding bootcamps', has developed.

Coding bootcamps are intensive training programs that aim to turn adults with little to no experience into employable programmers, software developers and data scientists, typically in 3–4 months. Due to their short timeframes and lack of competitive entrance requirements, they have been framed as

an alternative mode of entry to the technology 'pipeline', particularly for groups who have been historically excluded from careers in computing and data science (Byrd, 2025; Department for Digital, Media, Culture and Sport, 2022; Schnell, 2019; Twine, 2022). Consequently, coding bootcamps have been seen as a solution to a series of problems, including the UK's 'digital skills gap' (Nugent, 2022) and wage stagnation (Department of Science, Innovation and Technology and Donelan, 2024; Nania et al., 2019). While there has been some debate about the extent (and even existence) of such 'skills gaps' in the UK and elsewhere (Banerjee et al., 2024; Cappelli, 2015; Smith, 2017; White and Smith, 2022), the promises of coding nonetheless offer a compelling

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narrative for policymakers and jobseekers alike. In February 2024, then-Science and Technology Secretary Michelle Donelan announced a total of £550 million in funding for a network of government-supported ‘skills bootcamps’, with the aim of ‘upskilling’ 64,000 people in cloud computing, software development, data and analytics, cybersecurity, and web development by 2025 (Department of Science, Innovation and Technology and Donelan, 2024). These ‘no-skills-required’ bootcamps have been described as a fast track to a ‘comfy pay packet’, particularly for young people (Department of Science, Innovation and Technology and Donelan, 2024).

The recent campaign for the UK government skills bootcamps relies on some of the key promises made by coding bootcamps in Western contexts. These promises are three-fold: one, they provide access to traditionally gatekept industries; two, they guarantee a good job, and three, that careers in the computing and data industries will be financially remunerative (Miltner, 2019, 2022) and act as a ‘pipeline to prosperity’ (Davies and Eynon, 2018). Progressing from basic digital literacy to specialised digital skills like computer programming has also been framed in research (Francis, 2019; Schnell, 2019) and policy (e.g., Nania et al., 2019; Williams et al., 2021) as a mechanism for upward social mobility for traditionally marginalised groups. The potential of coding bootcamps – and the promises that they make – have been highly profitable, with the value of the global bootcamp market estimated at over USD\$1 billion, with projected growth to almost USD\$4 billion by 2027 (Research and Markets, 2023).

However, despite the runaway success of the bootcamp model globally and the UK government’s investment in it domestically, it is unclear whether UK coding bootcamps make good on their key claims. Most of the research on bootcamps comes from outside the UK (e.g., the USA and South Africa), and while there has been some research into coding bootcamp pedagogies in the UK (Bikanga Ada and Foster, 2023; Tarling et al., 2020, 2022), there is a dearth of evidence on UK bootcamp attendees and their motivations, experiences and outcomes. There is little data on the demographic and socioeconomic characteristics of bootcamp attendees in the UK, or how such factors shape learner experiences and outcomes. UK bootcamp attendees’ motivations also have not been explored in-depth, particularly in relation to how these motivations vary by demographic and socioeconomic characteristics. This study responds to this research gap and has two key aims. The first is to establish who goes to coding bootcamps in the UK, and why: what is the demographic makeup of bootcamp attendees, and what motivates learners from different demographic and socioeconomic backgrounds to enrol? The second aim was to identify the key factors that impact bootcamp students’ experiences and outcomes: for whom did the promises of coding bootcamps (particularly regarding digital skills acquisition and employment benefits) come to

fruition, and for whom did they not? And if the benefits of bootcamp attendance accrued unevenly, what were the aspects in play?

Our research demonstrates that while some participants benefit from coding bootcamps in alignment with the discourse about them, this is not the case for everyone. In doing so, this research casts doubt on the bootcamp model as a one-size-fits-all solution for the challenges of (and inequalities in) the UK digital economy, and establishes several directions for future research on this topic. Our study reveals that there are several demographic factors that impact bootcamp experience and success in the UK, including age, disability, immigration history, caring responsibilities, and financial circumstances. Overall, bootcamps tend to benefit younger, non-disabled, native British people who do not have caring responsibilities and who are not struggling financially. While this in and of itself does not mean that coding and data science bootcamps are devoid of worth, it certainly contradicts the discourse around learning to code that fetishises computer programming and data science as accessible gateways for excluded groups looking to obtain coveted, well-remunerated roles in the digital industries. In doing so, this work makes clear that developing specialised technical skills is not enough on its own to overcome structural inequalities in the UK context. It also makes a contribution to a growing literature that illustrates how bootcamps fail to deliver social mobility for the most marginalised (Byrd, 2025: 7; Rushworth and Hackl, 2021; Twine, 2022).

Literature review

The demand for ‘coding’ in the UK

The rapid adoption of digital technologies in the workplace since the early 2000s has led to a growing demand for digital skills, including ‘coding’, a popular umbrella term for computer programming, software engineering, and web development. Digital skills cover a wide range of competencies and knowledge required to use Information and Communication Technology (ICT) effectively in everyday life and employment. While not uniformly defined across government (e.g., National Careers Service, n.d.), industry (e.g., Strack et al., 2017), or academia (e.g., Van Laar et al., 2020), digital skills are considered highly desirable in a technologically-driven labour market.

A report commissioned by the Department for Digital, Culture, Media and Sport (DCMS) categorised digital skills into ‘baseline’ and ‘specific’ (Nania et al., 2019). Baseline digital skills, such as using Microsoft Word or Zoom, are considered essential across the vast majority of jobs and sectors in the UK workforce. While they are necessary for entering employment, their widespread use means they offer little competitive advantage. Specific digital skills, by contrast, are grouped into clusters that reflect more specialised capabilities and are

typically associated with technical or medium-to-high-skilled roles. Within this framework, coding is recognised as a specialised digital skill which also plays a foundational role in other ICT fields like data science, where it is combined with statistical and analytical techniques.

Research shows that there has been consistent growth in the number of ICT jobs over the last decade across OECD nations (OECD, 2024). In the UK, this tech sector upsurge has created considerable demand for digital and data workers (Department for Education, 2021; Nania et al., 2019). Evidence shows that the tech industry's expansion has outpaced the number of computer science, engineering and STEM graduates entering and staying in the UK labour market, contributing to a 'digital skills shortage', that especially pertains to specialised competencies such as computer programming and data science (Department for Education, 2021).

The debate surrounding the extent and impact of the STEM and digital skills deficit has received criticism and the existence of 'skills gaps' has been questioned entirely (e.g., Cappelli, 2015; Smith, 2017). Researchers have shown considerable inconsistencies in defining and measuring STEM skills, alerting that this could lead to inaccurate estimations of the actual UK 'skills gap' and misleading market demand projections (Banerjee et al., 2024; White and Smith, 2022). Furthermore, STEM education and the coding discourse have been criticised as heavily influenced by a neoliberal ideology prioritising capitalist industry-focused principles over social justice and empowerment for marginalised groups (Abbate, 2018; Mudaly and Chirikure, 2023). Nonetheless, there is a notable sentiment amongst employers that job applicants lack the necessary skills, with recent employer surveys revealing perceived difficulty in recruitment in the ICT sector across the UK (Tech Nation, 2024). It has been estimated that the chronic shortage of digitally qualified professionals costs the UK economy £63 billion per year, positioning the so-called 'digital skills gap' as a critical productivity problem (Department for Digital, Culture, Media and Sport, 2022).

Learning specialised digital skills, including coding and data science, has been framed in research (Francis, 2019; Schnell, 2019) and policy (e.g., Nania et al., 2019; Williams et al., 2021) as a means for improving employment and socioeconomic outcomes for historically marginalised groups. First, digital and data skills are seen as a potential safeguard for low-skilled workers in manual and clerical roles against the threat posed by AI and automation (Edge Foundation, 2024; Nania et al., 2019). Second, digital and data skills are seen to offer better career prospects (Nania et al., 2019) and 'strong wage outcomes' (Lewis et al., 2024: 8). Digital and data skills programmes are also seen as a way to address persistent inequalities in the tech sector concerning gender, race and ethnicity, and social class (e.g., BCS, 2021, 2023; Williams et al., 2021). However, despite decades of interventions seeking

to boost women's participation in STEM education and the uptake of technical jobs, there remain considerable inequalities relating to gender (Hutchinson, 2014; Smith and White, 2019), class (Archer et al., 2023), disability (British Science Association, 2021; Joice and Tetlow, 2021) and race and ethnicity (BCS, 2023) within the digital and data fields.

Concerns regarding the persistent inequality in the digital and data economy coupled with panic around the digital and data skills shortage have encouraged government and private sector interventions that seek to provide the UK workforce with a range of technical skills (Department for Digital, Culture, Media and Sport, 2022). Subsequently, a digital and data training industry has emerged to ensure sustainable economic growth, retain the UK's position as a technological leader in a competitive global market, and combat social inequality in the tech industry (Department for Digital, Culture, Media and Sport, 2022; Tech Nation, 2024). Investments have been made in initiatives to strengthen traditional computer science and data education and new digital training programmes, including technology-related apprenticeships and coding bootcamps that can 'rapidly integrate industry trends into the training environment' (Department for Digital, Culture, Media and Sport, 2022, n.d.).

Coding bootcamps

Coding bootcamps are accelerated training programmes designed to equip adult learners with the skills, knowledge, and attitudes required for careers in the digital and data industries. These intensive programmes typically last from a few weeks to a year, with most falling between 3 and 4 months (Byrd, 2019; Miltner, 2019; Rea, 2022; Williams et al., 2021). The contemporary bootcamp model emerged in the early 2010s in response to the exhortation that everyone can (and, in fact, should) learn to code, an idea which has gained significant traction in industry, policy, education, and public discourse since the early 2010s (Miltner, 2019; Miltner and Gerrard, 2022; Williamson, 2016).

Initially framed in the literature as a 'competitor to traditional computer science education' (Hendricks, 2023: 1), the coding bootcamp model is now recognised as a potential supplement to university degrees (Hendricks and Edwards, 2024; Wilson, 2018). A key selling point for most coding bootcamps is that they claim to rapidly prepare learners from any educational, demographic and socioeconomic background for entry- and mid-level tech jobs (Kaynak, 2019). As such, most coding bootcamps have fewer entry requirements compared to university courses: interest and passion for technology and the ability to demonstrate motivation to work in the digital and data sectors are often used as selection criteria instead of academic qualification or relevant professional experience (Thayer and Ko, 2017; Williams et al., 2021).

The typical coding bootcamp curriculum combines academic and industry elements, offering theoretical foundations and practical training. Bootcamp pedagogies rely heavily on active learning and learning-by-doing pedagogies, such as completing group projects and client briefs (Miltner, 2019; Rea, 2022; Tu et al., 2018). Alongside developing technical and transferable skills, coding bootcamps strongly emphasise understanding the digital and data ecosystems and preparing learners for employment. As such, learning activities include guest speakers, specialist masterclasses, real-world challenges, and client and mentorship sessions (Miltner, 2019; Tu et al., 2018; Williams et al., 2021). Further, work readiness support includes career workshops, networking sessions, job searching and application support, and job interviews, some offered by industry collaborators (Miltner, 2019; Tarling et al., 2022; Tu et al., 2018; Williams et al., 2021).

The bootcamp format is often seen as one of its advantages, particularly for aspiring programmers from marginalised groups. The short duration is perceived as a benefit for learners who cannot commit to a 3–4-year degree due to factors such as financial (Francis, 2019; Lyon and Green, 2020; Schnell, 2019) and family commitments (Francis, 2019). The flexible entry requirements can benefit young people or adults with little or no prior computer or data science experience, potentially removing participation barriers for learners who could not otherwise enter these industries (Francis, 2019; Schnell, 2019). To combat social inequality further, some coding bootcamps specifically recruit from groups that are underrepresented in STEM, computer, and data science (Williams et al., 2021), while other programmes are open only to learners from specific social groups, such as women (e.g., She Codes, Code First Girls), ethnic minorities (e.g., Coding Black Females, Black Codher), and refugees (e.g., Code Your Future; see also Rushworth and Hackl, 2021). Furthermore, the coding bootcamp model's flexibility allows it to respond quickly to changing market demands and train people for roles in emerging fields such as cybersecurity, artificial intelligence (AI), FinTech, and quantum computing (Department for Digital, Culture, Media and Sport, 2022).

However, there are multiple barriers to participation in such training programmes. To start, there are barriers to awareness (Lewis et al., 2024; Thayer and Ko, 2017). There are also barriers relating to social support (Thayer and Ko, 2017), including meeting the costs of attending such courses (Dzvpatsva et al., 2023; Lewis et al., 2024). Hidden costs can add to the financial burden, and those experiencing digital poverty may also lack access to suitable devices and face connectivity issues (Williams et al., 2021). Negative perceptions of the tech sector are seen as an additional barrier, including beliefs that the industry has a toxic culture (Schnell, 2019) and that tech jobs are difficult, complex, and involve antisocial working patterns (Lewis et al., 2024). Learners reported feeling they are

not intelligent, 'cool', or 'nerdy' enough to fit in, and, for ethnic minorities and women, a lack of role models was also linked to a lack of belonging (Thayer and Ko, 2017).

In the UK context, the bootcamp model and its pedagogies have started to appear in the literature (e.g., Bikanga Ada and Foster, 2023; Davies and Eynon, 2018; Tarling et al., 2020, 2022). However, there is little available evidence on the demographic and socio-economic characteristics of UK bootcamp attendees, and even less is known about how such factors shape learner experiences and outcomes, particularly in private bootcamps. With the exception of two reports from the Department for Education (CFE Research, 2023; Department for Education, 2021), the motivations for UK-based coding bootcamp attendees have not been explored in-depth, and certainly not in relation to how these motivations vary by demographic and socioeconomic characteristics. Overall, this study aims to address several gaps in the literature and reinforce existing findings from studies that show how promises made by bootcamps do not necessarily come to fruition (e.g., Williams et al., 2021).

Method

This project used an online survey ($n = 193$) to explore the characteristics of UK bootcamp attendees, and to investigate the relationship between these characteristics and bootcamp attendees' experiences and outcomes.

Survey design

To evaluate our instrument's design and content, we conducted a two-stage pilot. First, we piloted five thematically organised and interconnected questionnaires from December 2020 to January 2021 using a small snowball sample. Participants began by completing a demographic questionnaire before moving on to four follow-up questionnaires: the first focusing on participants' choice of bootcamp and that bootcamp's pedagogy, the second on participants' social experiences in their bootcamp, the third on their personal finances, and the fourth on their employment history and prospects post-bootcamp. After undergoing some revisions after the first stage of the pilot to improve comprehensibility, condense the surveys, and streamline the topics included for analysis, three interconnected surveys were launched in July 2021 for the second stage of the pilot: one focused on demographics and participants' motivations for attending a bootcamp, one focused on participants' social experiences, and one focused on employment and finances. Due to low response rates for the second and third surveys, all surveys were taken offline and condensed into a single survey, removing more detailed questions about participants' social experiences during their bootcamp, their finances, their job search, and their overall opinions about learning to code. This revised survey was

relaunched in February 2022. Respondents who completed the initial three questionnaires had their responses recoded to fit the final survey and allow for the inclusion of their data. Data collection concluded in August 2022.

Sampling and recruitment

The population of inference for this project includes adults 18+ who attended a coding bootcamp in the UK. This encompasses learners who paid for their course and those who were funded or attended for free. Individuals who started a coding bootcamp course but stopped before completing it are also included in the target population. A sampling frame or an estimation of the population of coding bootcamp learners in the UK is unavailable for researchers because there is neither a formal list of all coding bootcamps operating in the UK nor administrative data on all enrolled and graduating students in such institutions. As such, we used a convenience sampling procedure to recruit participants who attended coding bootcamps in the UK for the survey.

We recruited participants in three ways. First, we compiled a list of private, non-profit, and social enterprise coding bootcamps that were operating in the UK in 2021–2022. We used this list to contact institutions, inform them about our project and ask them to distribute the survey to their alumni networks. We endeavoured to obtain a reasonable representation of learners from across the UK, but certain areas (e.g., London) had a higher concentration of bootcamps. We also engaged in a paid social media campaign in an attempt to reach a broader swath of participants. Finally, we engaged in snowball sampling, asking our networks and contacts to spread the word about the project. To encourage response rates, participants were given the option to enter into a prize draw for several £50 gift cards.

Participants

A total of 325 participants completed the survey via the online platform Qualtrics. Participants who attended courses offered by universities as part of a degree, not-for-profit organisations, or open course providers (e.g., Coursera) were removed from the sample as they did not meet the criteria of bootcamp learners. Those who did not report the name of their training school but who otherwise fit the coding bootcamp criteria, based on their course length and provider type, were included in the final sample. Participants with missing data were removed. Our final sample consisted of 193 participants, with 132 participants excluded from the dataset for not fitting the criteria. Because there is no available data on the population of interest, and given we used a convenience sampling technique, it is impossible to calculate the response rate.

Data analysis

To estimate whether there are statistically significant differences in the experiences and outcomes of coding bootcamp learners from different demographic and socioeconomic groups, we used the Chi-squared test of independence. This test is suitable for examining the relationship between two categorical variables (Ho, 2017), for example, whether disabled and non-disabled coding bootcamp learners' course completion rates are statistically different. The Fisher's Exact test was used where the expected cell frequencies were less than 5. These tests allowed us to determine which groups have better (or worse) learning journeys and outcomes. While logistic regression models can be used to estimate the simultaneous effect of a number of independent variables on a categorical dependent variable, we deemed this option inappropriate due to the small sample size in this study. The data were analysed using SPSS v.29.

Results

Our analysis focuses upon the demographic characteristics of UK bootcamp attendees, their motivations for enrolment, their experiences at their bootcamp, and their post-bootcamp outcomes relating to employment.

Who attends coding bootcamps in the UK?

Our results show that bootcamp attendees tend to be young, White, educated, and with some degree of financial stability. Table 1 shows a relatively equal gender distribution among coding bootcamp students (52% women compared to 48% men). Seventy per cent were aged 18 to 40 years, while the remaining 30% were 41 years or older. Twenty per cent of respondents identified as belonging to ethnic minorities (excluding White minorities), and 29% had self-declared physical or mental disabilities, including neurodiversities, mental health conditions, and other long-term health conditions. Additionally, 28% of the sampled bootcamp students had caring responsibilities, and 29% faced financial struggles during their course.

Coding bootcamp students in the UK tend to be highly educated; 71% of respondents held a degree-level qualification, with one in three achieving a postgraduate degree before enrolling. Half of the respondents also had previous experience or familiarity with the subject(s) learned in their bootcamp before enrolling, mainly through informal instruction (e.g., independent study, learning from others) and on-the-job digital skills and coding training. Among 41-year-old or older bootcamp students, 61% had such prior experience compared to 45% of 40-year-olds or younger ($p = .04$). Students with a disability or long-term illness were more likely to have previous experience than those without such conditions (61% compared to 46%,

Table 1. Sample demographics of UK coding bootcamp participants (overall $n = 193$).

		%			%	
Age ($n = 192$)	18–29	34	Education ($n = 193$)	PG degree	36	
	30–40	36		UG degree	35	
	41–50	18		Sub-degree	29	
	51–60	8		Income ($n = 167$)	Below £10,000	19
	61+	4			£10,001–£20,000	10
Gender ^a ($n = 188$)	Men	48	£20,001–£30,000		17	
	Women	52	£30,001–£40,000		23	
Disability ($n = 179$)	Yes	29	£40,001–£50,000		16	
	No	71	£50,001 or over	15		
Sexual Orientation ($n = 189$)	Straight/heterosexual	70	Financial well-being while enrolled ($n = 153$)	I was struggling/really struggling	29	
	Gay/lesbian/bisexual/self-describe/unsure	30		Neither struggling nor comfortable	32	
Ethnicity ($n = 188$)	White	80	Language use at home ($n = 193$)		I was comfortable/really comfortable	39
	All other ethnic groups combined	20		Only English	63	
Primary subject learned ($n = 178$)	Data Science	25	Caring responsibilities ($n = 193$)	Yes	28	
	Software engineering	35		No	72	
	Web development	35	Time lived in the UK ($n = 166$)	Always	57	
	UX/UI/digital marketing/other	5		Not always	43	

^aDue to the ethical considerations associated with our sample size, participants who self-identified as non-binary or third gender were removed from this and subsequent analyses.

Table 2. Bootcamp learners' previous experience with the subject of their training programme and the main reason to enroll, by demographics (%).

		I had previous experience	Non-work-related reasons ^a	I wanted a more exciting job/money	Better long-term career prospects/job security	I wanted a job in a specific industry
Total ($n = 174$ – 171)		50	10	13	38	39
Gender ($n = 170$ – 166)	Men	55	12	13	35	40
	Women	47	7	12	42	39
Age ($n = 173$ – 170)	40 years and under	45*	9	17	37	37
	41 years or over	61*	12	4	40	44
Ethnicity ($n = 170$ – 176)	White	51	10	13	39	38
	All other ethnic groups combined	50	9	15	27	49
Disability ($n = 160$)	Disability	61 [^]	15	13	43	30
	No disability	46 [^]	8	14	34	44
Language(s) ($n = 174$ – 171)	English Only	45*	11	12	39	38
	English + others	59*	8	13	37	42
Income ($n = 158$ – 149)	Below £10,000	54	11***	21***	39***	29***
	£10,001–£30,000	36	10***	6***	40***	44***
	£30,001–£50,000	44	11***	19***	36***	34***
	Over £50,000	60	0***	0***	39***	61***
Financial well-being while enrolled ($n = 151$ – 150)	I was struggling or really struggling	36	16	16	32	36
	I was neither struggling nor comfortable	41	4	13	52	31
	I was comfortable / really comfortable	58	9	12	33	46

^aThis includes reasons like general interest, curiosity, hobby/fun, and making a difference in the world.

* $p < .05$; ** $p < .01$; *** $p < .001$.

respectively, $p = .06$). Fifty-nine per cent of students who used languages other than English at home had previous experience compared to 45% of those who used only English at home ($p = .04$).

Motivations for enrolling in a bootcamp were primarily related to career goals, with a small minority being explicitly influenced by financial considerations. As can be seen in Table 2, 39% of respondents enrolled in their course to access or retain a job in a specific industry, with a higher rate of respondents in the higher income bracket than those in the lowest income bracket indicating this was their main motivation (61% compared to 29% respectively, marginally significant at $p = .10$). A further 38% undertook their coding bootcamp training as a means to achieve better long-term career prospects and job security, 13% were motivated by the prospects of getting into a more exciting or financially rewarding job, and 10% had non-work-related motivations such as general interest, curiosity, hobby/fun, and making a difference in the world. Thirty-five per cent of participants reported software engineering as the primary subject of their course, 35% selected Web development, 25% selected Data Science, and 5% undertook bootcamp training in UX/UI, digital marketing, and related subjects (see Table 1).

Experiences of coding bootcamp students

Survey respondents generally expressed satisfaction with various aspects of their bootcamp training, with 85% agreeing or strongly agreeing that the course was worth the time spent, and 69% expressing agreement or strong agreement that it was worth the money invested. The rate of students agreeing that the course was worth the money was higher for younger participants than older students (74% vs 62%, $p = .08$). Furthermore, students in the highest income bands had higher rates of agreement with this statement than those in the lowest income bracket (100% compared to 62%, $p = .01$). There was a similar marginally significant positive trend between rating the course as worth the money and financial well-being ($p = .06$). Students in the higher income bracket were also more likely to report they would do the course again if given the opportunity than counterparts in the lowest income bracket (91% vs. 73%, marginally significant at $p = .10$). Overall, 68% reported they would do so.

However, despite the fact that students felt that their courses were good value for money and worth their time, less than half of the sampled students (43%) achieved a Net Promoter Score (see Kara et al., 2022), a metric often used in market research to explore customer sentiment; in this case, a 'promoter' score indicates that students were highly satisfied and likely to recommend their course or provider. The percentage of promoters was notably lower among disabled students: only a third of them would recommend their bootcamp to others, compared to almost half of those (47%) without a disability ($p = .07$). Similarly, only

30% of people who identify as LGBTQ+ achieved a Net Promoter Score, which is much lower compared to the number of straight/heterosexual participants who did so (48%, $p = .03$).

Perhaps one explanation for these low recommendation scores is the negative experiences that some students faced. Table 3 shows that 16% of the sampled bootcamp students experienced or witnessed bias in their courses. The rate of such negative experiences varies across demographic factors, with a higher percentage among women than men (19% vs 11%, marginally significant at $p = .10$), disabled individuals compared to their non-disabled counterparts (26% vs 14%, $p = .07$) and those who faced financial struggles during their course compared to peers who were not struggling (25% vs. 10%, $p = .09$). Older students reported a higher percentage of bias (21%) than younger ones (14%), but this difference did not reach statistical significance.

These negative experiences could also help explain the comparatively high dropout rates: about 1 in 6 bootcamp students did not complete their course (see Table 4). Younger students had higher completion rates than their older counterparts (89% vs. 75% respectively, $p = .02$). People with caring responsibilities were over three times more likely to drop out of their coding bootcamp (31%) compared to people without caring responsibilities (9%, $p < .001$). Additionally, non-disabled students demonstrated higher completion rates in comparison to those who reported having a disability or illness (87% vs. 78%); however, this difference in completion rates did not reach statistical significance.

Coding bootcamp student outcomes

Coding bootcamp attendance did result in positive outcomes for their attendees, but these advantages accrued unevenly, with the biggest benefits going to participants who were White, English-speaking, UK natives who were higher earners and self-reported as financially comfortable.

This inequity becomes evident when examining employment-related outcomes. Students with higher incomes were more likely to secure employment post-bootcamp: more than 90% of participants in the two top income bands found employment compared to 78% in the second lowest income bracket and only 25% of those in the lowest one ($p < .001$). Similarly, students with higher incomes reported a salary increase more frequently than those with lower incomes (67% for the highest earners and 10% for the lower earners, $p < .001$). A lower proportion of participants who only spoke English at home looked for a job post-bootcamp compared to those who spoke another language at home (67% vs. 83% respectively, $p = .02$): this was because the English-only speakers either already had a job or were hired before they completed their bootcamp. Similarly, students who rated themselves as financially comfortable searched for a job less frequently than those

Table 3. Bootcamp learners' experience with bias and satisfaction with their course, by key demographics (%).

		Experienced/ witnessed bias? (% Yes)	Course worth the time? (% Yes)	Course worth the money? (% Yes)	Would you repeat course? (% Yes)	Net Promoter Score (% Promoter)
Overall (n = 163)		16	85	69	68	43
Gender	Men	11***	81	71	69	40
(n = 158–159)	Women	19***	88	67	68	48
Age	40 years AND under	14	86	74***	70	46
(n = 162)	41 years or over	21	83	62***	65	39
Ethnicity	White	17	85	72	68	41
(n = 159–160)	All other ethnic groups combined	16	85	61	73	55
Disability	Disability	26***	81	70	67	33***
(n = 151)	No disability	14***	87	71	69	47***
Income	Below £10,000	15	87	62*	73***	39
(n = 150)	£10,001–£30,000	19	81	61*	66***	44
	£30,001–£50,000	12	82	71*	63***	44
	Over £50,000	19	100	100*	91***	52
Financial well-being while enrolled	I was struggling/really struggling	25***	80	60***	60	40
(n = 152)	Neither struggling nor comfortable	13***	81	71***	63	35
	I was comfortable/really comfortable	10***	90	81***	76	46
Sexual orientation	Straight/heterosexual	13	84	68	68	48*
(n = 189)	Gay/lesbian/bisexual/ self-describe/unsure	21	87	72	67	30*

* $p < .05$; ** $p < .01$; *** $p < .10$.

who faced financial challenges during their courses (89% vs 62%, respectively, $p = .01$) because they also either had a job or got one before they completed their bootcamp.

Participants who were older, had a disability, were from an ethnic minority group, or were migrants to the UK also faced challenges in the labour market. A further breakdown of bootcampers' employment seeking patterns show that it took 38% of people with disabilities four months or more to get a job after completing their course, compared to only 19% of non-disabled people ($p = .06$). Fifty-three percent of people who have always lived in the UK got a job before completing their bootcamp or within less than a month of finishing, compared to only 26% of people who have not always lived in the UK ($p = .02$). A notable 61% of ethnic minority (excluding White minority) respondents were still looking for a job at the time of the survey, either because they didn't like the job they got or never got a job post-bootcamp; this is double the rate of White people in the same circumstances (31%, $p = .01$). Even when employment is secured, salary increases are more likely to happen for younger people: half of the students in the 40 and under age group reported a salary increase after their course. In contrast, less than a third of the 40+ age group experienced a similar positive outcome (27%) ($p = .02$).

Discussion

The discourse about learning to code – as well as UK governmental policy concerning the so-called 'digital skills gap' – suggests that learning to code and attending coding and data science bootcamps is beneficial for both individuals and the UK economy (Department of Science, Innovation and Technology and Donelan, 2024). This discourse also suggests that bootcamps are a democratising force that will address Equality, Diversity, and Inclusion (EDI) issues in the tech industry by offering an alternative 'pipeline' into the tech industry for minoritised groups (Stewart and Feldman, 2024). Our research indicates that such claims are overstated, and are indicative of a technosolutionist approach that offers superficial solutions to systemic inequalities (see Black, 2022; Königs, 2022).

This study demonstrates that the demographics of coding bootcamp attendees in the UK are indeed varied: UK bootcamps have a good proportion of women (52%), people with disabilities (29%), Black and minority ethnic people (20%), people who have not always lived in the UK (43%) and speak a language other than English at home (37%). These are approximately equal to (or in some cases, more than) the equivalent proportion of these groups in the

Table 4. Course completion rates, job hunt trends, and salary change, by key demographics.

		I completed the course (n = 178) %	I looked for a job after the course ^a (n = 159) %	I got a job after their course (n = 116) %	% reporting a salary change after completing or leaving their course (n = 152)		
					Decrease	None	Increase
Overall		84	73	73	14	43	43
Gender	Men	86	72	79	16	41	43
	Women	83	73	70	12	45	43
Age	40 years and under	89*	75	75	12*	38*	50*
	41 years or over	75*	68	71	18*	55*	27*
Ethnicity	White	84	73	74	15	42	43
	All other ethnic groups combined	87	72	70	10	48	42
Disability	Disability	78	73	65	20	47	33
	No disability	87	73	77	11	41	48
Language(s)	English Only	84	67*	75	7	43	50
	English + other(s)	84	83*	71	18	44	38
Income	Below £10,000	89	83	25**	37**	53**	10**
	£10,001–£30,000	74	66	78**	10**	56**	34**
	£30,001–£50,000	82	75	94**	10**	37**	53**
	£50,001 or over	96	71	93**	14**	19**	67**
Financial well-being while at bootcamp	I was struggling/ really struggling	82	89**	67	18	38	44
	Neither struggling nor comfortable	80	69**	76	6	51	43
	I was comfortable/ really comfortable	85	62**	81	14	41	45
Previous experience	Yes	84	71	79	16	40	44
	No	85	76	68	13	46	41
Caring responsibilities	Yes	69**	67	63	20	48	33
	No	91**	75	77	11	42	47

^aReasons for not looking for a job were getting one before finishing or leaving the course, retirement or not requiring employment (for example, staying in one's current job). A few participants reported they didn't look for a job due to disability/illness, caring responsibilities, or because they were not allowed to work. Due to the small number of participants in this category, their responses were removed from the analysis in this table.

* $p < .05$; ** $p < .01$; *** $p < .10$.

population of England and Wales: women comprise 51% (Wood et al., 2023); Black and Minority Ethnic people comprise 18% (Garelick, 2022), and people with disabilities, 24% (Kirk-Wade et al., 2024) of that population. People with English as a main language comprise 91% of the UK population (Waddington, 2022), indicating that coding bootcamps are unusually diverse in this aspect.

However, while the population of coding bootcamps might be relatively diverse, especially in relation to typical computer and data science degree programmes (see Archer et al., 2023), the benefits of attending a coding bootcamp are not equally distributed, which challenges popular claims about coding acting as a 'social equalizer' (e.g., Khamallah, 2020). Our research illustrates that the promises made by coding and data science bootcamps are more likely to come true for certain types of people: UK natives who speak only English, are under the age of 40, have some financial resources, and do not have caring responsibilities or a disability.

The impact of participant finances on bootcamp success is significant. People in the top two salary bands were less likely to experience bias, were more likely to secure employment and were more likely to receive a salary increase after attending a bootcamp. Perhaps unsurprisingly, they were also more likely to view their experience at their bootcamp positively. These kinds of patterns have also been found outside the UK: in a US-based study, Jabbari et al. found that participants in technical training programmes who had the lowest incomes when entering the programmes did not see an income increase over time (2024: 16). One explanation for these outcomes is that higher earners have the time and focus to be able to devote not only to their programmes, but to the notoriously demanding recruitment processes of the tech job hunt. It takes considerable time and effort to secure employment after attending a bootcamp, with applicants often submitting dozens upon dozens of job applications before securing an interview (Miltner, 2019; Schnell, 2019; Thayer and Ko, 2017). Having

financial resources can facilitate the type of focus on this task that isn't afforded to those who need to apply for jobs and work simultaneously.

Age also plays a significant role in bootcampers' experiences and outcomes. Bootcamp attendees over the age of 40 were less likely to complete their course or agree that it justified the money that they spent. Despite the fact that they were more likely than their younger counterparts to have previous computational experience, they were less likely to report an increase in salary after completing their training. It's possible that the older group were already on higher salaries and reached a salary ceiling that couldn't be surpassed with extra training. However, given that students with higher incomes were more likely to receive salary increases than those who were in lower income brackets, the most likely explanation is that, in a notoriously youth-obsessed industry (Gosselin and Tobin, 2018; Stypińska et al., 2023), older bootcamp attendees were simply faced with ageism, particularly in the types of entry-level, junior roles available to bootcamp graduates (see Doyle, 2020).

Bootcampers experiencing marginalisation also seemed to have less success with bootcamps. Disabled participants took longer to find a job than non-disabled participants; ethnically minoritised participants took much longer than White participants, which was also the case in the US (Twine, 2022). Those who spoke languages other than English were less likely to receive a salary increase after attending their bootcamp, even though they were more likely to have previous experience. People with caring responsibilities were far less likely to complete their courses, and LGBTQ+ respondents were less likely to recommend their bootcamps than heterosexual respondents. Collectively, these results indicate that coding bootcamps are perhaps not as inclusive as policy (e.g., Lewis et al., 2024) and the broader coding discourse (see Miltner, 2019, 2022) might suggest. Our findings also align with qualitative work that has shown that bootcamps can be challenging environments for people experiencing marginalisation (e.g., Miltner, 2019; Rushworth and Hackl, 2021).

Despite this, the rates at which people reported bias within bootcamps was low. Part of the explanation for this might be the fact that structural biases can be difficult to identify by those who are experiencing them (Kaiser and Major, 2006). Another explanation could be that the issue was not necessarily with the bootcamps themselves, but with the tech labour market, which is infamously challenging to break into, especially for bootcamp grads (Forbes Technology Council, 2017; Kessler, 2024). Twine's US-based research on all-women bootcamps demonstrated that those who were able to break into the tech industry after a bootcamp had a very specific and narrow profile: they were young, White, university educated, middle class, and 'either heterosexually married to or in a domestic

partnership with a White male engineer who was embedded in a technology network' (2022: 201).

Our research primarily illustrates how different groups benefit differentially from coding bootcamp attendance based on different demographic or social characteristics. However, it is worth highlighting that for those who don't end up receiving the promised benefits of bootcamp attendance – improved employment prospects, increased salary, social mobility – this is not merely a lack of benefit, but an active harm. Coding bootcamps are challenging environments that cost not just money, but also time, energy, and effort that many attendees can scarce afford (Miltner, 2019, 2022; Rea, 2022; Thayer and Ko, 2017). Particularly for those who see bootcamp attendance as a lifeline, the failure to derive the promised benefit from their programme can be devastating, not just financially, but also emotionally (Miltner, 2019; Miltner et al., 2023). In this way, coding bootcamps can even perpetuate inequality, operating contrary to their stated aims.

Conclusion

This study surveyed adult alumni of UK coding bootcamps to understand who enrolls in coding bootcamps and what their motivations are for doing so, what their experiences are in the bootcamp, and what their employment-related outcomes are after they complete their training. The results of this project illustrate the complex interplay between tech 'upskilling'/'reskilling' and employment market outcomes. We found that while bootcamp attendees are demographically diverse, bootcamp attendance tends to particularly benefit people with specific characteristics: White, English-speaking UK natives who have at least some financial resources, do not have caring responsibilities, do not have a disability, and are under the age of 40. This contradicts the prevailing wisdom that everyone should learn to code (e.g., Elkins, 2018) and that coding bootcamps are engines of social and economic mobility for marginalised groups.

Our study has several methodological limitations. With no available sampling frame of learners and graduates, we opted for using a convenience sample, recruiting participants online based on a self-created list of coding bootcamps. This sampling method is vulnerable to selection bias which might result in an overrepresentation of certain groups while underrepresenting others, and as such, caution should be taken in generalising the findings. But even without a nationally representative sample, our results clearly demonstrate that merely increasing access to training opportunities for marginalised groups is not a panacea for social mobility. Furthermore, our work makes a valuable contribution to a growing body of international literature on coding bootcamps that shows how they fail to make good on their promises for marginalised groups (e.g., Byrd, 2025; Twine, 2022).

Consequently, our research indicates that current policy and programmes, while well-intended, are not enough to address longstanding structural inequalities in education and work. There is some evidence that apprenticeship programmes can lead to positive outcomes for those who complete them, but even then, those with the lowest incomes tend not to benefit (Jabbari et al., 2024). There has been some research that has illustrated how efforts at inclusion and equity can improve learning and feelings of self-efficacy amongst bootcamp attendees (Rea, 2022), but this work says little about longer-term outcomes and the impact on social mobility. We suggest that intensive bootcamp-style training without a clear pathway into the labour market disproportionately benefits those from more advantaged backgrounds. For bootcamp learners from minoritised groups, access to training alone is insufficient and does not translate into labour market success. A structured system is needed to improve conversion from training to employment, and to support sustained progression within the workplace.

Furthermore, while it may be tempting to look to practical solutions to make coding bootcamps more effective, the longer *durée* of coding bootcamps and technical training programs suggest that larger structuring forces are in play. The focus on learning to code and the development of coding bootcamps is yet another iteration of a historical hype cycle that positions technical skills as a solution for social mobility and inclusion (Ames, 2019; Miltner, 2022; Sims, 2017; Teitelbaum, 2014). As has been demonstrated time and again in the Science and Technology Studies and computing history literature (e.g., Hicks, 2017; Miltner, 2022; Slaton, 2010), having specialised digital competencies like coding and data science skills does not guarantee a job as a programmer or data scientist, despite breathless claims about ‘skills gaps’ and worker shortages; this is because narrow ideas of what a ‘good programmer’ is and what ‘cultural fit’ looks like often act as exclusionary forces. As computing historian Mar Hicks argues, ‘initiatives to get girls, women, and people of color to train for STEM jobs cannot undo the underlying structures of power that have been designed into technological systems over the course of decades’ (2017: 325). Byrd similarly argues that coding bootcamps operate ‘in a racial hierarchy that valorizes whiteness’, and that learning to code is ‘shaped by racial and economic ideologies’ that are excluded from discourses ‘on the wonders of computer code bootcamps’ (2025: 7).

The public release of generative AI tools such as ChatGPT since 2022 has shifted the discourse about coding, with ‘AI doom mongers’ declaring that coding jobs are now a ‘waste of time’ (Cross, 2023). Perhaps unsurprisingly, questions are being raised about the value and future of coding bootcamps after the ‘death knell of coding jobs’ (Kessler, 2024). However, given the proclamations about ‘expanding education pathways’ and ‘increasing the

diversity of the talent pool’ that were recently made in the UK Government’s *AI Opportunities Action Plan* (Department for Science, Technology and Innovation, 2025), the appeal of rapid upskilling is likely to be stronger than ever. As the UK looks to swiftly develop its ‘pool of AI skills and talent’ (Department for Science, Technology and Innovation, 2025), it would do well to note that meritocratically-rooted upskilling/reskilling programmes like coding bootcamps tend to benefit those in more privileged positions, and that efforts to increase human capital alone are unlikely to lead to upward social mobility for marginalised people. We also suggest that, just as coding was only very recently heralded as the new literacy of the twenty-first century, AI is now emerging as its successor. Yet framing AI as a must-have skill for all (Hwang, 2025; The Royal Society, 2025) mirrors earlier techno-optimist narratives around coding, where its contextualisation as universally essential often overstated its relevance, overlooked structural inequalities, and blurred the line between foundational and fashionable skills.

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Data availability

Data supporting this publication can be freely downloaded from the University of Sheffield research data repository at <https://doi.org/10.15131/shef.data.30998857>, under the terms of the Creative Commons Attribution (CC BY) licence.

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