Identity and Belonging for Graduate Apprenticeships in Computing*

The experience of first cohort degree apprentices in Scotland

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ABSTRACT

In September 2017, our university's first graduate apprentices began degrees in Software Development, Cybersecurity, and Information Technology Management for Business. This study explores how apprentices experience their association with the university and identities as students, but also employees. In Scotland, Graduate Apprenticeships (GAs) are undergraduate degrees in which the students are in full-time employment, while completing degree modules over four years, as for a traditional full-time degree. The curriculum follows a skills framework designed by employers so that graduates have the professional and technical attributes required by the industry. The degrees parallel Degree Apprenticeships in England, though there are national differences in implementation.

Themes of identity and belonging are central to current investigations of the experience of STEM students, especially computing students, as fewer students choose STEM courses, and many transfer out of their subjects or do not complete their degrees. The research hypothesis is that the apprentices' employment will provide a strong IT professional identity supports their progress at university.

Semi-structured interviews with apprentices in the first computing cohorts explored their situated perspectives. Responses were identified which concerned the apprentices' identity as students or employees, including themes around belonging. Thematic analysis of these responses revealed that apprentices defined themselves in opposition to traditional student identities and did draw strength from their identity as employees. They experienced belonging specifically within their GA cohort—the first of its kind in the university. A better understanding of identity and belonging can be used by universities to address the challenges of retention.

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CCS CONCEPTS

• Social and professional topics → Computing education

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1 Introduction

Graduate and degree apprenticeships in computing provide new opportunities for Higher Education Institutions (HEIs) to implement degrees that are aligned to contemporary industry and the digital needs of the public sector, leading to appropriately-skilled and experienced graduates. The degrees can also provide opportunities to widen access and diversify the student population, as apprentices do not need to take on student debt. As the apprentices are working in the industry, they are likely to have conceptualisations of computing and IT professions that, situated in their own experience, are grounded and more nuanced than those of a first year on-campus student. This may be helpful in their studies, in terms of personal and subject-specific engagement.

Research in European and North American countries indicates a shortfall of young people intending to become scientists, and engagement problems for students studying STEM subjects [16]. In computing, this is reflected in retention problems. Data about UK students, for example, records that 10.5% of undergraduates who started computing degrees in 2015/16 left higher education without achieving any awards, compared to 6.4% across all subjects [10]. Biggers, Brauer, and Yilmaz [1] highlight the parallel issue of students who stay in higher education, but transfer out of Computer Science majors. Various studies have hypothesised that these retention problems have their roots in students' conceptions of computing, especially in narrow predictions of the activities they will

encounter while studying computing and in future careers [1, 16, 19, 20]. In the early years of their degrees, students expect a focus on programming, which is creative and rewarding for some, but lacking in human contact and meaning for others [1, 16, 19]. This study investigates the experience of first year graduate apprentices [GAs], studying computing subjects, in Scotland. As full-time employees, these GAs have situated experience of computing and IT in the workplace. They may also have established IT-identities as IT-admin, helpdesk, QA testers, or even developers. The research hypothesis is that *the apprentices' employment status will lead to the construction of a salient IT-professional identity that supports their progress at university*. The GAs' experiences and perceptions are gathered through narrative interviews, which are analysed using themes of identity and belonging in order to understand the relationships between the individual contexts of the apprentices and their experiences of studying on these innovative degrees.

2 Graduate Apprenticeships in Scotland

The degree apprenticeship agenda in the UK aims to improve the match between graduates' skills and employers' needs, by adapting and extending apprenticeship schemes into higher education [17]. The Richard Review [23] recognised the favourable public opinion of apprenticeships ("people react warmly", p3) and suggested ways to adapt the concept to contemporary needs. Employers would have a central role in designing the new apprenticeships through creating the standards (lists of required competencies) that would guide content and assessment in each subject [11, 12]. The apprenticeships would be funded through the new apprenticeship levy: all large employers have been liable for 0.5% of their salary costs, from April 2017" [21].

In Scotland, these higher-level apprenticeships are called Graduate Apprenticeships and the process is administered by Skills Development Scotland (SDS), an executive public body of the Scottish Government. SDS brings employers together to develop the frameworks that define graduate apprenticeships, currently in twelve, mostly STEM, areas [24]. HEIs propose implementations for each degree and bid for places, responding to SDS tenders. Successful HEIs promote their courses to employers and potential apprentices. Interested employers either identify potential apprentices in their staff or recruit people directly into the GA role and degree. In this way, the Graduate Apprenticeships are designed and implemented by a partnership of SDS, employers, and HEIs. As the partnership is embodied in the apprentices [4], their experiences and perspectives are of key value in examining the implementation of the degrees, especially efforts to identify what is working well or any emerging problems, and to suggest areas for improvement. The apprentices' perspectives can also reveal links between their individual contexts and their progress with the course. As apprentices are employed in various roles by diverse employers (from local start-ups to international companies to the public sector), they bring different experiences, opportunities, and challenges to their studies, especially work-based learning elements.

These new partnerships to create appropriately-skilled graduates are particularly important in computing, where there is a high demand for digitally-skilled employees, while, paradoxically, the transition from university study into graduate employment has seemed to be more challenging than for other subjects [25]. While more recent graduate destination data [9] shows UK IT graduate unemployment to be still relatively high, six months after graduation, at 9.2%, the HESA data also shows that few IT graduates are taking on non-professional (stop-gap) roles, such as hospitality or retail, and suggests that they hold out for the right professional role [8, 9]. The Shadbolt Review [25] noted the importance of work experience in bridging the gap between study and professional employment; Graduate Apprenticeships extend work experience into credit-bearing work-based learning, unambiguously defining the place of employment as a place of learning. GA degrees need to be carefully designed to enable apprentices to apply their developing skills and knowledge in their workplace, to allow them to master the learning outcomes outlined in the degree frameworks. The university also facilitates workshops for employer-mentors to support them in determining the context and scope of work-based learning.

As apprentices are salaried employees and their fees are paid, the scheme also has the potential to widen participation in higher education, though this may require specific strategies from employers as recruiters [e.g., see 18, 28, 29]. A deep exploration of the challenges and potential impacts of these degrees is essential if the scheme is to be successfully scaled up. This paper reports one such research implementation—interviews with first year graduate apprentices. The focus here is data concerning the apprentices' identities as employees and students, including where they experienced a sense of belonging—at university or at work.

3 Belonging and identity

Our university implements Graduate Apprenticeship degrees through teaching apprentices on campus one day per week (in the first two years), running modules through three trimesters (including the summer). On-campus learning provides important elements of the traditional university experience, including access to learning facilities, such as the computing labs and the library, and some shared sessions with on-campus students. Physical co-presence can help to develop the cohort as a learning community, including face-to-face relationships with staff [7, 30]. Pizza lunches are provided for apprentices and staff to further this process and to help monitor student experience. With dual roles as student and employee, this study set out to explore self-identification and sense of belonging in this new apprenticeship context.

Identity is considered to comprise a sense of self in relation to the multiple roles people hold, together with notions of value and meaning attached to such roles [26, 30]. For this study, the role of student and employee are significant. Identity within roles influences social interactions and thus impacts on relationships and behaviour: at university and in the workplace. Formulating a new identity, or identity construction, is the result of social processes such as following role models, interacting with networks, and imagining (or acting) in a role [26]. Identity also

affects a sense of belonging, where belonging is feeling at home, being respected, being welcomed [31], and a sense of connection [14]. Students' success and well-being at university depend on both academic and social factors, from the institution and the students, combined with the students' background and external influences [e.g., 15, 22]. Kahu and Nelson describe students' agency in terms of self-efficacy, emotion, belonging, and well-being [15]. For apprentices, these factors, especially self-efficacy and belonging, are likely to be influenced by both their employment contexts and their comparatively limited time on campus. The apprentice is the only stakeholder who can fully appreciate this: "Since there are at least two 'realities' involved (company and higher education institution) nobody except the student has a complete overview" [4, p.29].

Researchers have called for a greater understanding of identity construction among computing students [e.g. 1, 16, 19, 20], suggesting that undergraduate students' perceptions of the computing field may be misaligned to their personal identities and values. For example, Biggers, Brauer, and Yilmaz [1] are concerned with the social and academic integration of computing students. They compare students who leave a Computer Science (CS) major in a U.S. college, with those who stay, gathering their perspectives on the field and the course. They found that the leavers were frustrated by the lack of human interaction, perhaps because their courses were intensely programming-focused in the first year. Kinnunen et al. [16], studying undergraduate computing students in Finland, Sweden, and UK, suggest that students' perceptions of their current and future CS identities influence their propensity to enjoy or leave the subject. They noted a disparity between the students' expectations of the course (lots of programming) and their career aspirations (including managing their own companies). Enthusiastic students in both studies conceived of programming in terms of creating and problem solving.

This conceptualisation of computing/IT is elaborated more fully in Peters et al. [19, 20], where students' perceptions of coding and solving problems as creative and collaborative are understood in terms of *participation* as an essential attribute of learning and identity development, from Wenger's work on Communities of Practice [30]. For Wenger, negotiation of meaning is at the centre of identity development and this takes place through (ideally collaborative) participation and reification. Peters et al. identify this participation in computing students' narratives of creating through coding and collaborative problem-solving. They also find that computing students who do not experience this feel isolated in the human-computer dyad. These students foresee a future "hammering on the keyboard" [19, p. 7] and leave their computing course. Peters et al. suggest that their students' narrow concept of computing may reflect their rather homogenous CS student group and that education needs to support more advanced experiences of participation and richer ways of negotiating meaning. Apprenticeships would seem to be ideal contexts for this.

However, Graduate Apprenticeships present identity challenges for the apprentices, as they are regarded as having dual identities: employee and student. The apprenticeships are an intense combination of work and study, which is likely to challenge the apprentices [29], so it is vital for HEIs to understand their experience. Such insights are useful to HEIs who are currently planning or already running higher apprenticeships, as implementations need to be designed or adjusted to support this new type of student. This study explores the how the apprentices experience their dual identity. Does their work identity support or antagonise their student identity? Does their experience of IT in the workplace create a participatory IT-identity that supports and motivates the apprentices in their studies? To this end, we interviewed fifteen computing apprentices, halfway through their first year.

4 Methodology

The research aim of the interviews was to investigate the contexts of the apprentices: their backgrounds, their employment, their family lives, and their lived experience of being an apprentice. Semi-structured interviews were conducted with fifteen graduate apprentices studying Software Development, Cybersecurity, or Information Technology Management for Business, within the university's first cohort (of 26). The apprentices were encouraged to volunteer and all volunteers were interviewed. The interviews aimed to uncover the apprentices' backgrounds, especially their paths into IT and the Graduate Apprenticeship, as well as their experience of the degrees, once they had settled in. The approach reflected that of narrative interviews, which encourage interviewees to describe their lives as a series of events, thinking aloud about their trajectories [5, 13]. The narrative method was adapted to restrict interviews to an hour, given the pressure on the apprentices' time. The interview protocol focused on their experience of education and work, from school to the present, including their paths into working in IT. The apprentices were interviewed in their second or third trimester and asked about their experiences of the degree, in the contexts of their work-life and university study, including questions around identity and belonging. Of the fifteen interviewees, four were female; twelve were interviewed at their workplace and three at the university. Interviews were audio-recorded and transcribed. Following university ethics procedures, participants had been informed about the use of anonymised data from interviews and signed informed consent forms.

A dataset was created of transcript texts concerned with participants' experience of the apprenticeship, especially the integration between their studies and employment. This dataset was analysed using *thematic analysis*, following the processes described by Braun and Clarke [2]. Comments or narratives concerned with identity and/or belonging were identified by two researchers individually. Each researcher identified themes within these texts and coded the texts accordingly. Braun and Clark describe the identification of themes: "A theme captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set" [2]. The researchers resolved the themes, including hierarchical relationships between the themes, by discussion. This hierarchical thematic coding enabled related ideas to be surfaced across the interview transcripts and meaningfully grouped together providing a summary of the

responses of the participants, including areas where their experiences diverged. The resulting *map* of the apprentices' contexts and experiences highlights the strengths and challenges of the current implementation for this cohort.

5 Findings

5.1 Overview

Most of the interviewees talked about the links between what they were studying at university and what they did at work or the wider business or future needs of their organisations. However, this was one factor among many contributing to a graduate apprentice identity that supported their university study. There were many strong connections between their work identity and student identity and they specifically distinguished themselves from full-time students [Figure 1].

All the quotations have been lightly edited to remove grace phrases and repetition. Gender-neutral pronouns are used below to protect the students' anonymity. While the interactions between gender identities and work or student identities are important in this context, the small sample size, including four women, means that we cannot discuss gendered experiences here without comprising the participants' anonymity. The prevalence of themes in the interview texts is indicated by phrases such as "most of the participants" or "some interviewees", following the conventions for thematic analysis [2, p83] and providing some indication of the generality of experience among the participants, without providing specific percentages, which could be misleading.

5.2 Contextualising computing

Most of the participants experienced a positive connection between what they did at work and what they learned at university: "Like, everything we do in uni, I can relate back to my work. And stuff that we do at work, I can relate to uni as well. So it's good that way." For some, university study helped them to understand workplace processes: "[In class] I'll be thinking 'Well, we use that'' and when he's explaining it, I can see why we do certain things here that way." And "I then knew that's how you have your office system; that's our main system; this is what, all the things it can do. I think that was sort of a turning point. I realised what I was learning was actually helpful in here."

Some interviewees specifically noted the importance of this connection with their work, in contrast to on-campus degrees: "I'll learn stuff in uni and I'll come back and I'll say 'That's what that is' and things like that. So it's great to be able to sort of put the two together. I think that's more beneficial than sitting in a lecture all day and just having notes and stuff, but not actually having that sort of real world experience of it." One interviewee recognised how their interest in IT, developed at work, supported their study and how different this context was to starting a computing degree previously, on leaving school: "I'm more focused and doing quite well on the degree so far, I think…It's because it's something I'm wholly interested in and involved in on a day-to-day basis at work. But back then, it was: choosing computing because I thought it was the right thing to do, not because I wanted to specifically do it."

However, two interviewees, who were self-taught developers, had narrower conceptions of their work, which limited the potential for links with university. One was open to the relevance of learning Human-Computer Interaction and systems design, but noted "We don't get to decide how things are going to be started, how things are designed here." Another, for various reasons, experienced a total disconnect between their work and study, for example: "At this level or at this point, what we're learning currently here is not like directly applicable to my workplace. Because we're not going to learn about web development, especially not a specific area of web development that we do."

Several interviewees interacted with their work colleagues around their university coursework. Some inspired conversations between their workplace's developers about what they were studying at university. Some received practical help, for example colleagues helped them to understand a study topic by providing local examples: "Since starting, I've actually learnt other stuff as well from other members of the team. So, the software development module, I got to speak to [our Java developer] and he was helping me out…and explaining what things were in a work context, rather than just out of books and things like that. It's been great." This could involve help to get to grips with programming and even strengthen relationships in the workplace: "So, [my work colleague], one night we were here until 7 o'clock, just pinpointing everything that I was struggling with…And just getting that work-based knowledge of it helped apply what I was learning."

The link between work and study ran both ways and one interviewee described providing a real-world example of good system design in response to a lecturer's question. The apprentice worked as a developer in the public sector and had created a system based on in-situ observations of a daily problem: "In the lecture, somebody was talking about system design.. and I explained one of the things that we'd done...it's basically just sitting down watching what the problem was, coming up with solutions, agreeing it, doing test pilots, and then we went for it. And now they're doing it and we're nearly at a *million* requests, in four years." This example was provided in a large lecture, attended by both on-campus students and GAs, demonstrating how the lecturers are beginning to benefit from teaching the GA cohorts.

Many of the interviewees seemed to have entered IT careers tangentially, rather than fulfilling long-established ambitions, and a few spoke about finding their work rewardingly people-centric: "Certainly, the roles we're in just now, communicating with other teams and working closely with other teams, I would say is a big part of the job, and I think that's why I liked it the most. It's like building relationships with people, and working closely with other people." Several had started on-campus computing degrees, but not completed them. They valued this new opportunity to study, while engaged in practical, rewarding, and collaborative work, rather than the potentially isolating experience of leaving home and studying computing: "You're supposed to be getting your uni experience, but software engineering– if you want to sit and study and everything, it's not a very social activity to sit in your room and code."

So, with one exception, the apprentices experienced a strong positive connection between what they did at work and what they studied at university. Their work also provided full, lived experiences of computing, including collaboration and (for those working in a helpdesk role) solving people's IT problems. How did this influence their GA identities, as both students and employees?

5.3 Graduate apprentices' identities

Figure 1 summarises the identities of the graduate apprentices as students: i.e., at university and when working on their coursework elsewhere. This "GAs at-uni" identity draws on the specific nature of the cohort, as they band together as a group and are nurtured by university staff (the upper circle within their at-uni identity). They also bring confidence, support and, as discussed above, applied subject knowledge from their work role (the lower circle in their at-uni identity). However, they specifically distinguish themselves (the blue water) from "normal", full-time, on-campus students, and this becomes part of their identity.

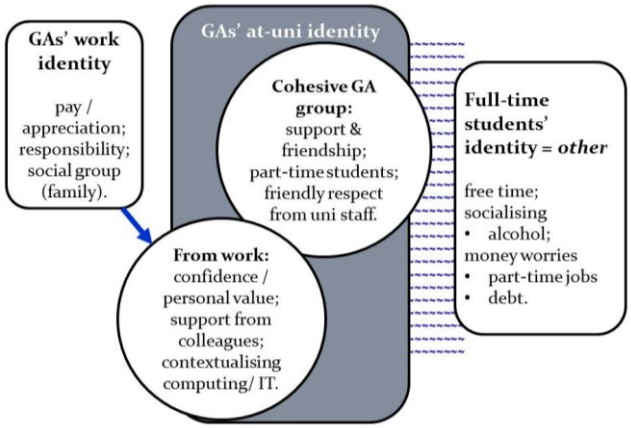

Figure 1: Graduate apprentices' identities (theme map)

Most of the interviewees conceived of themselves as employees, even when at university. Their employers paid their salary for their university day ("I get paid to do a degree") and their responsibilities continued through it: "I feel that weird disconnect, because you're still working and while you're at uni, your mind's still at work." While most of the interviewees had been in post with their employer prior to starting the Graduate Apprenticeship, two had been taken on specifically for this role and a few others had recently completed Modern Apprenticeships with their companies. (Modern Apprenticeships are shorter apprenticeships, primarily designed for young people). In this context, the nature of their identity as employees varied from people with established roles and expertise, even management responsibilities, to people new to their companies and in their first office job. One interviewee described their team as "a kind of larger family", while another called themself "so ingrained".

The apprentices conceptualised a traditional (full-time) student identity, which they did not share, with abundant unstructured time and alcohol-centred socialising. Several had started or completed traditional degrees and experienced this student identity: "I wasn't under any illusions that it was going to be like what a student life was before, because obviously people have jobs and it's not like we're going to be out boozing all the time." Some described themselves as part-time students. They also contrasted their financial status with traditional students' worries about money and debt. Interviewees recalled the experiences of relatives and friends doing traditional degrees: "having a part-time job and all that balance and moneys and loans and debts."

Although the apprentices defined themselves in contrast to the other students on campus, few expressed alienation. Rather, three factors supported their confidence at university. First, their job: they drew on their employee identity (status) as a strength. Some interviewees had established roles, skills, and responsibilities, which seemed to be important parts of their identity. Others were nearer the beginning of their IT careers and valued their employers' faith in them: "We'll pay your salary whilst you're out for that day, to get you trained up to come to work with us, because we feel like you deserve it and are capable of doing it." Several interviewees described work colleagues helping them with their university study, especially developers helping with programming challenges, as described above. Many interviewees described their managers as supportive, offering encouragement and practical support—even time and space to study if work downtime coincided with module deadlines.

Secondly, they experienced their cohort as a cohesive and supportive group. They shared their workplace experiences across organisations, helped each other, and enjoyed new friendships: "the people on the course generally, probably have made it easier, because you're like friends"; "If you're struggling, there's always somebody there to help you…that may know—will know something you don't know and vice versa."

Third, while there were some specific communication problems, interviewees also described the university staff as friendly and helpful, beyond their expectations. "I think what's been done well is the kind of pizza lunches, where we kind of get to actually talk to people, because it can be very difficult to have an actual chat about how things are going"; "I feel everybody's really nice, at the university. I think they're all—like you're all trying to help us." This raises questions about how these conditions will change over time, as the Graduate Apprenticeships become less novel and cohorts increase in size.

6 Outcomes, future work, and challenges

Instrumental outcomes of the first year included exceptional academic results and a 100% retention rate. In terms of this study, multiple identities as part-time students and employees were observed. The employee identity was most salient and impacted positively on their university study, through support from their employers and co-workers, as well as including a contextualised understanding of computing at the centre of their working worlds. Further, their employment provided motivation to study to fulfil their employers' expectations. Clearly, the GAs benefited from the integration between their study topics and work experience. They had a broad understanding of computing, including real-world goals and, in many cases, the importance of collaboration, whether

developing in teams or using IT to support collaborative work. Given the 100% retention rate, is our hypothesis supported? *Does the apprentices' employment lead to the construction of a salient IT-professional identity that supports their progress at university?* Yes. However, their IT-identity is not their only support mechanism, as they have banded together as a group and support each other and are also specifically supported by university staff implementing this new degree. So, there are important, additional factors to their IT-identity in their progress through their first year.

Their student identity was described in terms of otherness, difference from perceived on-campus student behaviour and values. This could signal the emergence of a new *professional* identity on the part of the Graduate Apprentice; whereby a combination of technical skills, capabilities, status and roles merge with work and life experiences into a "coherent image of self" [3]. A professional identity that values skills acquisition and application within a workplace context would certainly align with the aims of apprenticeship degrees. Fuller and Unwin [7] describe how even highly skilled knowledge workers may go on "an extensive learning journey" [p.218] and suggest that apprenticeships are stronger and richer learning environments when organisations support this journey [6]. However, the apprentices' conceptualisation of the school's on-campus students tends towards caricature, rather than representation, neglecting the proportions of our students that are older (e.g. 23% over 25) and the prevalence of work experience [27].

Belonging was expressed in two ways. The first, and strongest, sense of belonging to emerge from the narratives was that of belonging to the cohort of apprentices. A strong bond had been established between apprentices through shared but unique experience. The apprentices experienced their cohort as a locus for support, guidance, and light relief, with the underlying recognition that they were part of something new, with somewhat uncertain boundaries and expectations. The second was a sense of belonging to the university, demonstrated, for example, in recognising the respect shown by university tutors.

This consideration of identity and belonging will inform the course team's review of the way the apprenticeship course is structured and delivered, including implementation plans for later years. The findings raise questions for the team: if student identity is the less salient identity, what will happen as the university study course components reduce in favour of the work-based learning component? Will the university degree award begin to seem less valuable to the apprentices than at the beginning? If the work-identity is the main source of the apprentices' strength, is it vulnerable to changes in the workplace? Furthermore, the sense of belonging facilitated by the cohesion of the apprentices as a cohort may be challenged when work-based learning diverges through differing employment contexts, with consequently fewer opportunities to relate and share, even potential for jealousy. Future work will examine these tentative predications of experiences, through research with apprentices as they continue their degrees. This research will be carefully planned to respect the time of the apprentices, both as employees and time-pressured students. Employers will also be involved in the research programme, both to gather their perspectives and to ensure that they understand how this fits with the ongoing development of the Graduate Apprenticeship scheme.

7 Impact

Apprenticeships represent a new and significant investment in skills, funded through the Apprenticeship Levy. The stakes are high for these apprenticeships to fill the skills gaps, as articulated earlier. As increasing numbers of universities start to implement higher apprenticeships, they share a desire for apprentices to successfully achieve their degrees and add value to their employing organisations. Increasing awareness of apprentices' lived experiences, through exploring their self-identification and the roots of their sense of belonging, can usefully influence the approaches universities take to supporting these new learners. The National Student Survey (funded by the UK government) now includes a question relating to being part of a community of students and academic staff, which is likely to encourage universities to develop their understanding of notions of belonging, especially through the perceptions of diverse types of students. However, given the importance of students' conceptualisations of computing and their growing IT-identities to their progress through computing degrees, researchers need to continue to explore identity and belonging at a school or subject level in computing.

The insights from this study of apprentices, revealing some of the factors influencing their sense of belonging as students and its impact on their studies, are also likely to be relevant for certain groups of on-campus students. Universities interested in the sense of community amongst their students can benefit from exploring the perspectives of students on diverse learner journeys. Computing departments in particular can usefully find ways to strengthen and deepen their students' conceptualisation of computing and their personal and collaborative IT-identities.

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