Response to the DSIT Women in Tech Taskforce call for evidence: 'Building a future tech sector that works for everyone'.

22nd April 2026

About the Authors

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Executive Summary

Women remain significantly underrepresented in the technology workforce. The cost of this underrepresentation is substantial for individuals and society. Higher Education (HE) is a critical stage in this pipeline where cultural norms are established and young women make lasting decisions about their relationship with technology, developing the confidence and sense of belonging that inform whether they enter and remain in the tech workforce. HE is vital to improving entry, progression, retention, and leadership for women in the tech sector.

This response draws multi-method intensive qualitative doctoral research (Li, forthcoming, 2026) examining women's identity construction in computing education at UK research-intensive universities. Our research shows that interventions based solely on increasing access to computing and the tech sector are unlikely to succeed without addressing educational environments and the cultural norms of computing that shape everyday participation. Students' engagement with computing is influenced by classroom interactions, assessment structures, teachers' expectations, peer dynamics, and implicit norms. These dynamics shape how women students in computing position themselves in relation to the field and make career commitments. Understanding this foundation is essential. Engaging with education as a site of early identity formation and cultural reproduction offers a sustainable route to change. The evidence presented in this response highlights how targeted interventions in educational contexts can contribute directly to building a more inclusive, resilient, and diverse tech workforce.

Our policy recommendations:

1. Strengthen links between education, industry and employment pathways.
    - expand opportunities for placements, internships, and returner programmes, to provide clearer and more accessible transitions into the tech workforce.

2. Develop national guidance to shape inclusive definitions of technical ability.

3. Embed real-world problem-solving in computing curricula at school-, further- and higher education levels.
    - support extracurricular and project-based initiatives that enable students to engage in applied, real-world problem-solving.

4. Embed inclusive curriculum design principles within national guidance for computing education by including structured pathways, scaffolded learning, and flexible entry points, to support students with diverse prior experiences and improve retention;

5. Support qualitative research into the diverse experiences of woman and underrepresented groups in computing education.

The response provides evidence and policy recommendations in relation to the following questions: Q21/22, Q23, Q24, Q25, Q26.

Response to Questions

Our research focuses on women's experiences in computing education in UK higher education, examining identity, participation, and learning culture. Based on the findings, this response examines how emerging technologies, particularly AI, are reshaping the skills required in the tech sector in ways that are deeply entangled with existing gendered dynamics. These shifts are not only technical, but also cognitive and social, with important implications for women's participation, progression, and the shaping of graduate workforce readiness.

The study adopts a multi-method qualitative approach, including ethnographic observations of teaching and learning environments, biographical narrative interviews and photo election interviews with students, and interviews with a range of academic staff. The research is grounded in four months of intensive fieldwork conducted from October 2025 in anonymised UK research-intensive universities. Data comprises over 15 hours of student photo elicitation interviews, 10 biographical narrative interviews (BNIM), 6 hours of staff interviews, and more than 80 hours of observation, spanning computer science lectures, workshops, labs, tutorials, and informal learning settings. The findings are unpublished but with publication due in late 2026, the research offers timely, practice-relevant insights into women's participation in computing education.

21. At which stages in education or work do you think support is most important for helping women and people from under-represented groups enter, stay in, and progress within the tech sector?

22. Please tell us why you think these stages matter, and what contributes to women or people from underrepresented groups facing barriers at these points.

We identify two stages in the talent pipeline: first, **at school** through early exposure to computing and subject choice and second, **in higher education**. These are key intervention points shaping women's participation, progression, and retention in the tech workforce.

Why these stages matter

These decisive stages shape women's computer science identity[1] including how they understand their fit, capability, and future trajectory within technology. Research evidence consistently shows that underrepresentation of women in tech is not only a matter of entry, but of attrition across the pipeline, with losses occurring as early as school and continuing through higher education into the workforce.

Our research shows how these processes unfold in practice:

- At school level, early exposure to computing is often mediated by gendered expectations, which narrow aspirations unless actively countered by supportive teaching, parental support and inclusive environments.
- At higher education level, everyday learning environments (lab, lecture, seminar, group work) play a critical role in shaping participation and retention, with peer interactions, teaching practices, and norms around competence influencing women and marginalised students' confidence and sense of belonging.

School and HE are active transitions points where participation is sustained or lost with direct implications for the UK's skills pipeline, and graduate workforce diversity.

Barriers at these stages

A key structural barrier identified is the persistence of a 'masculine default'[2] in computing education. This is a culture in which male-associated behaviours and forms of knowledge are treated as the norm, shaping how competence is recognised and rewarded.

Evidence from our research shows:

- Technical competence is often associated with speed, confidence, and prior exposure, disadvantaging (women) students without these forms of capital.
- Male students are more readily recognised as knowledgeable by educators, while women's contributions are more likely to be questioned or require validation.
- Emphasis on perceived 'innate talent' over effort, undermines the confidence of women and marginalised groups.

1 Holmegaard, H., Archer, L., Godec, S., Watson, E., MacLeod, E., Dewitt, J. and Moote, J., 2025. Feeling the weight of the water: A longitudinal study of how capital and identity shape young people's computer science trajectories over time, age 10–21. *Computer Science Education*, *35*(2), pp.238-266. https://doi.org/10.1080/08993408.2024.2320009

2 Cheryan, S. and Markus, H.R., 2020. Masculine defaults: Identifying and mitigating hidden cultural biases. *Psychological Review*, *127*(6), p.1022. https://doi.org/10.1037/rev0000209

- Curricula and assessment structures often prioritise individual, technical problem-solving, with less recognition of collaborative, applied, and/or socially relevant dimensions of computing.

Together these dynamics represent a 'chilly climate'[2] for women students, reducing confidence, belonging, and retention. This sets in train patterns of attrition, reinforcing underrepresentation at later career stages and ultimately limiting the diversity of the tech workforce.

Q21-22 Recommendations:

- **Embed real-world problem-solving in computing curricula at school-, further- and higher education levels.**

Embedding real-world topics and projects broadens engagement and supports a wider range of students to see themselves as part of the tech workforce; For example, projects focussed on HCI for digital accessibility where acute skills gaps exist, in view of digital inclusion legislation (e.g. the European Accessibility Act, 2025).

- **Develop national guidance, to develop inclusive definitions of technical ability.**

Narrow educational measures based on speed or prior learning disproportionately disadvantage women and other underrepresented and marginalised groups. National guidance, grounded in research and developed with the BCS (the Chartered Institute for IT) and other degree accreditation bodies, will ensure more inclusive definitions of technical ability that promote genuinely inclusive computing education.

23. Which initiatives and interventions, if any, have helped women and people from underrepresented groups develop and progress in their tech careers?

Impactful interventions combine community-based support, inclusive curriculum design, and structured exposure to career pathways, rather than focusing on access alone.

Effective interventions

1. Community-based and career-focused initiatives

Community-led and student-focused initiatives play a critical role in supporting participation by strengthening students' sense of belonging and professional identity. For example, UK-based initiatives such as the Lovelace Colloquium, alongside workshops and career events, provide opportunities for students to:

- Engage with role models and industry professionals[3].
- Present their work and reflect on their experiences.
- Build networks and develop clearer career pathways into the tech workforce.

Our research indicates that these initiatives are particularly effective in supporting retention and progression, as they help students to see themselves as part of the tech community and to

3 Kunkeler, T. *et al.* (2025) 'Same structures, different settings: Exploring computing capital and participation across cultural contexts', *Proceedings of the 25th Koli Calling International Conference on Computing Education Research*. New York, NY, USA: Association for Computing Machinery (Koli Calling '25), pp. 1–10. https://doi.org/10.1145/3769994.3770041.

understand realistic entry routes into the sector. Near-peer and professional connections appear especially important in shaping sustained participation.

2. Curriculum design and structured progression pathways

Interventions at the curriculum level are also critical in supporting participation, retention, and skills development. Findings suggest that programmes which:

- Provide introductory pathways and differentiated entry points.
- Offer scaffolded progression across levels of difficulty.
- Support students without prior technical experience.

are more effective in sustaining engagement than approaches that prioritise early specialisation or assume prior knowledge.

Students reported that such structures enabled them to build confidence, competence, and persistence over time, directly supporting their ability to remain and progress within computing pathways. These findings highlight that inclusive participation is not only driven by outreach or community initiatives, but by how computing education is designed, sequenced, and delivered.

3. Early exposure and applied engagement with technology

International evidence highlights the importance of early, applied engagement with technology, particularly at school level. Activities that allow students to interact with real-world applications of computing, for example through hands-on, project-based or context-rich experiences can make technology more accessible and meaningful, supporting broader participation.

Early exposure initiatives are most effective when they demonstrate how technology is used across different domains, helping a wider range of students to see themselves as part of the future tech workforce.

Q23 Recommendations

- **Embed inclusive curriculum design principles within national guidance for computing education.**
    - include structured pathways, scaffolded learning, and flexible entry points, to support students with diverse prior experiences and improve retention.
- **Strengthen links between education and employment pathways**
    - expand opportunities for placements, internships, and returner programmes, to provide clearer and more accessible transitions into the tech workforce.

24. Which initiatives and interventions, if any, have helped women and people from under-represented groups influence decisions or shape emerging technology areas?

Drawing on our findings and wider literature, this response examines how initiatives and interventions have supported women and underrepresented groups to influence decisions and shape emerging technology areas. Evidence suggests that influence is closely tied to the conditions under which individuals are able to contribute, be recognised, and shape outcomes within collaborative environments.

Enabling influence through equitable participation

In higher education, collaborative learning environments play a critical role in shaping students' capacity to influence decision-making and contribute to technological outcomes in team settings. These environments act as early sites where norms of team-working, participation, authority, and expertise are established, with direct implications for future roles in the tech workforce and in the design of emerging technologies.

Our study shows underrepresented groups (including Muslim women, Asian women, and Black women) are often marginalised in collaborative interactions. They typically have fewer opportunities to contribute, and their ideas are more likely to be questioned or overlooked. This reduces their ability to influence group decisions and shape outcomes, reinforcing unequal participation and setting precedents that extend into professional contexts. These dynamics mirror patterns observed in technology development environments, with implications for who is able to shape the design and application of emerging technologies.

Interventions that introduce structured and equitable participation mechanisms have been shown to mitigate these dynamics. These include:

- Clear role allocation within group work.
- Assessment frameworks that make individual contributions visible.
- Transparent criteria for recognising different forms of expertise.

These approaches significantly improve women and minoritised students' ability and opportunity to participate, creating more equitable conditions and developing influence.

Broadening pathways to influence through applied and socially relevant engagement

Programmes such as Engineers Without Borders show how interventions can expand opportunities for students to shape technology in practice. Through design challenges, collaborative projects, and real-world problem-solving, these initiatives enable students to:

- Engage with diverse perspectives.
- Define and frame problems.
- Contribute to the development of solutions.

Our evidence suggests that these environments are experienced as more conducive to participation than settings focused narrowly on technical performance. Women reported greater confidence in contributing ideas and influencing decisions in these contexts.

By embedding technology within socially relevant and applied contexts, such programmes shift the focus from demonstrating technical ability, to shaping how technology is used and developed, supporting students' agency and influence. This is vital for emerging technology areas such as AI, where decisions about design, application, and impact are shaped only by those who are able to participate meaningfully in these processes. Thus, interventions must address the conditions that enable individuals to influence decisions and shape outcomes.

Q24 Recommendations

- **Support extracurricular and project-based initiatives that enable students to engage in applied, real-world problem-solving.**

- **Creating opportunities to shape technological solutions rather than only demonstrating technical competence.**
    - Examples include project-based learning, inquiry-based learning, service learning, sprints and hackathons (e.g. the Accessibility Internet Rally; Global South AIS Hackathon; All-girls hackathon for responsible AI;)

25. Which, if any, initiatives or interventions that have previously been used now feel less effective as the tech sector changes, and what changes or alternatives would you suggest?

Many initiatives have focused on promoting coding as the central entry point into technology which provide hands-on experience for girls. However, interventions that are coding-centric can convey 'brogrammer[4] culture' stereotypes from industry. Furthermore, we find a growing emphasis on application, design and interdisciplinary problem-solving as the UK's digital economy matures and AI enters the coding workflow. In this context, coding is increasingly understood by educators as a foundational skill rather than the sum-total of computing competencies. As a result, interventions that position coding as an end in itself risk alienating students, particularly those from marginalised and underrepresented groups, and those from non-traditional backgrounds, who have less prior-learning experience. These approaches may also implicitly narrow perceptions of what careers in tech involve, limiting participation in a sector that increasingly values and requires diverse skills and perspectives.

Q25 Recommendations

- **Strengthen links between education and industry**

Help students to understand diverse career pathways and develop relevant skills. Create opportunities to reflect on non-linear pathways from education into the tech sector. Expand extracurricular and industry-linked initiatives that focus on real-world applications of technology. For example, recommendations described in Q23 and Q24.

26. Is there anything else that you would like to share to inform the work of the Women in Tech Taskforce?

Research on women in computer science tends to treat women as a homogeneous group, but they are not. Biographical factors such as prior educational experience, school learning culture, and student computer science identities influence how young women progress through university, college and apprenticeships into tech careers. Dimensions such as class, ethnicity, disability, gender-identity, maternity, caring-status and age (amongst others) are also significant factors. Data insights remain uneven. Student characteristic data (such as gender, ethnicity, disability) are collected in national data sources (e.g. National Student Survey, and Higher Education Statistics Agency (HESA) data) to assess metrics of student satisfaction, progression and career destinations; however, the reality is considerably more complex. Further, international students represent a third of undergraduates in the UK, yet they remain significantly underrepresented in data on participation and experience in computing education. This is concerning given that women students arrive with different experiences and pedagogical expectations that are not always recognised within UK higher

4 Brooke, S., 2025. "Python is for girls!": Masculinity, Femininity, and Queering Inclusion at Hackathons. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems* (pp. 1-13). https://doi.org/10.1145/3706598.3713235

education. Longitudinal and qualitative research is required to trace how women students' identities, confidence, and sense of belonging in computing develop over time and across contexts.

Q26 Recommendations

- **Support qualitative research into the diverse experience of woman and underrepresented groups in computing education.**
    - Complement current data (HESA statistics, Office for Students data, National Student Survey satisfaction data, Graduate Outcomes Survey, and Longitudinal Education Outcomes (LEO) surveys) by encouraging research that explores student experiences of inclusion/exclusion, learning gain and biography.

DOI: 10.5258/SOTON/PP0175