The Institute of Coding: A University-Industry Collaboration to Address the UK's Digital Skills Crisis

***Abstract*—The Institute of Coding is a new £40m+ initiative by the UK Government to "transform the digital skills profile of the country". In the context of significant national and international policy scrutiny, it responds to the apparently contradictory data that the country has a digital skills shortage across a variety of sectors, yet the higher education system produced computing graduates every year who end up unemployed, or underemployed.**

The Institute is a large-scale national intervention to address some of the perceived issues with formal education versus industry-focused skills and training, for example: technical skills versus soft skills, industry-readiness versus "deep education", and managing expectations for the diverse digital, data and computational skills demands of employers across a wide range of economic sectors, in an increasingly multicultural and "smart" world.

All of this is taking place at the higher education/industry interface at the same time as substantial computer science curriculum reform across the four nations of the UK – especially in England, with a new computing curriculum from 2014, in which all children are expected to learn two programming languages, as well as wider computer science fundamentals and develop transferable computational thinking skills.

In this full paper, we describe the background, evidence base and rationale for the Institute of Coding, its key themes and current activities, as well as anticipate its likely impact over the coming years. Furthermore, we reflect on the potential replicability of aspects of this national Institute of Coding case study (and related initiatives in the UK) to other nations or regions with similar ambitions to address the "digital skills crisis".

I. Introduction

Across the world there are a plethora of initiatives and interventions to address the wider societal challenge, and the corresponding skills shortages [1] of the so-called digital economy. While there is a strong socio-economic policy focus, it should not just be about jobs: we want, and need, a digitally competent, capable and engaged citizenry. But this widespread ambition provides challenges for long-term, coherent policy-making: what do we mean by digital skills? In recent years, we have seen a multitude of policy reviews and reports from across government, academia, think tanks, learned societies and charities that have attempted to encapsulate some of the issues, as well as identifying potential solutions. At least three recent UK Parliament Select Committee inquiries [2]–[4] have, wholly or in part, focused on the 'digital skills crisis'. They have all made a number of specific recommendations, from curriculum and qualifications reform, improving professional learning for practitioners, investment in infrastructure, developing effective pedagogies and the wider educational research base in the UK, through to terminology, fixing 'leaky pipelines' and changing the wider public perceptions of digital/technology disciplines.

Alongside substantial curriculum reform across the UK [5], including a new national curriculum in England [6] and emerging reform in Wales [7], we have also seen significant changes to the available qualifications, based on perceived rigour, content, distinctiveness and modes of assessment. The publication in 2017 of a follow-up report on computing education in the UK from the Royal Society [8] framed some of these national challenges in the context of computing for all, calling for a coherent strategy so that all learners are equipped and empowered with the necessary skills to be effective in the digital world.

However, it is clear that from all of these various reviews, reports, activities, initiatives and interventions, there remains a lack of policy coherency and connectedness – more so when it cuts across ministerial portfolios, or requires multi-year coordinated support. In this paper we frame some of these strategic challenges – and opportunities – and introduce the Institute of Coding, a new £40m+ initiative by the UK Government (but focused on England, with related activity in Wales) to transform the digital skills profile of the country [9].

II. The Institute of Coding

Formally announced in 2018 [10], but foreshadowed in 2015 [11], the Institute of Coding is one of the UK Government's latest responses to the "digital skills challenge" [9]. The Institute brings together a consortium[1] of research- and teaching-focused universities (primarily based in England due to the origin of the core funding, along with two Welsh institutions co-funded through a separate mechanism), large corporates, small- and medium-sized enterprises (SMEs), established industry groups, experts in the delivery of distance/non-traditional learning and professional bodies to develop and deliver innovative, industry-focused education across the UK. It is explicitly an industry–university collaboration, with the Government contributing at most 50% of the project funding.

It brings together for the first time traditional computer science departments and business schools, leaders in art and design, innovation in programme delivery, the industry backing of the UK's leading digital employers, and the leading professional bodies. The Institute's vision is that "every student

[1]For full list of IoC partners, see: https://instituteofcoding.org/about/team/

leaves education with employment, and that employers and individuals across the UK have ready access to the skills they need to compete successfully in the global digital economy". It is structured around five priority themes[2] which directly align to the conference themes of engineering education in an increasingly multicultural and "smart" world, which will be explored in more detail in the full paper, along with the Institute's key outputs and impact so far:

Theme 1: "University Learners"

To increase the number of university learners and improve employability through innovative learning methods:

Theme 2: "The Digital Workforce"

To create learning that meets employer needs, enriches the student experience and provide in-work and flexible learning options that are viable at scale:

Theme 3: "Digitalising the Professions"

To develop learning to address sector-specific digital skills needs, build an industrial strategy and deliver modular training:

Theme 4: "Widening Participation"

To develop a path from first contact to employment, removing barriers to entry and progress for poorly-served groups:

Theme 5: "Knowledge Sharing and Sustainability"

To horizon scan for future digital skills need, disseminate and share best practice of the project, look at long-term sustainability and the management of the programme:

III. Impact, Future Work and Replicability

The Institute of Coding is certainly "work in progress": at the time of writing it was two years on from the official launch announcement [9]. With numerous activities and initiatives – at both the regional and national level – cutting across all five work themes. It has an implicit aim to provide a national cohering role – especially at post-compulsory level – collaborating with other organisations working on school-level interventions to create the sustainable ecosystem to address some of the challenges articulated in the full paper.

We are now seeing a number of successful initiatives, activities and interventions which may prove useful to other nations reforming their curricula (both compulsory school-level, as well as post-compulsory), as well as in the wider aim of developing broader – sustainable and transferable – societal digital, data, computational and engineering skills. However, we recognise that there has been a significant corpus of activity in this space, both in the UK and internationally – from existing alternatives such as baselining and identification of best practice (e.g. [12]), cybersecurity education and degree accreditation (e.g. [13]), microdegrees, MOOCs, coding universities, industry-specific university-industry coding collaborations, boot camps, etc – with a multitude of initiatives purporting to fix the problem; it is thus important not to replicate past failures.

However, two overarching themes are apparent; firstly, such effort has to be viewed as a coordinated multi-pronged approach, requiring an overarching holistic strategy, working collaboratively with universities, colleges, employers including but not limited to industry, local and national government, as well as young people, parents and the wider public. Secondly, there is a need to overcome the challenges of recurrent funding and support to ensure long-term sustainability of the interventions – across the four nations of the UK – as well as ensuring parity of opportunity for all young learners. Whilst we do not necessarily recommend replicating some of the policy structures under which the UK operates, especially national quality assessment exercises, they can provide a useful policy lever for initiatives such as the Institute.

The Institute of Coding thus aims to provide an important and impactful national cohering role, collaborating with other organisations working on school-level interventions, providing a platform for conducting research activities; building the evidence base and informing education policy and practice; supporting accreditation and standards; as well as changing the wider perception – and economic, societal and cultural importance – of 'ICT', 'digital', 'coding' and other cognate skills.

[2]See: https://instituteofcoding.org/about/

References

[1] CECE, "Informatics education in europe: Are we all in the same boat?" The Committee on European Computing Education, jointly established by Informatics Europe & ACM Europe, Tech. Rep., 2017.

[2] House of Lords Select Committee on Digital Skills, "Make or Break: The UK's Digital Future," UK Parliament, Tech. Rep. HL 111, 2015.

[3] House of Commons Science and Technology Committee, "Digital Skills Crisis," UK Parliament, Tech. Rep. HC 270, 2016.

[4] House of Lords Select Committee on Communications, "Growing Up with the Internet," UK Parliament, Tech. Rep. HL 130, 2017.

[5] N. C. C. Brown, S. Sentance, T. Crick, and S. Humphreys, "Restart: The Resurgence of Computer Science in UK Schools," *ACM Transactions on Computer Science Education*, vol. 14, no. 2, pp. 1–22, 2014.

[6] Department for Education, "National curriculum in England: computing programmes of study," https://www.gov.uk/government/publications/national-curriculum-in-england-computing-programmes-of-study, 2013.

[7] F. Moller and T. Crick, "A University-Based Model for Supporting Computer Science Curriculum Reform," *Journal of Computers in Education*, vol. 5, no. 4, pp. 415–434, 2018.

[8] Royal Society, "After the reboot: computing education in UK schools," Royal Society, Tech. Rep., 2017.

[9] J. H. Davenport, T. Crick, A. Hayes, and R. Hourizi, "The Institute of Coding: Addressing the UK Digital Skills Crisis," in *Proc. Computing Education Practice 2019*. ACM, 2019, pp. 10:1–10:4.

[10] Department for Education, "Prime Minister announces £20 million Institute of Coding," https://www.gov.uk/government/news/prime-minister-announces-20-million-institute-of-coding, 2018.

[11] HM Government, "Chancellor's speech to GCHQ on cyber security: Chancellor lays out new plan for £1.9 billion cyber investment, and details seven more departments that have settled ahead of the Spending Review," https://www.gov.uk/government/speeches/chancellors-speech-to-gchq-on-cyber-security, 2015.

[12] E. Murphy, T. Crick, and J. H. Davenport, "An Analysis of Introductory Programming Courses at UK Universities," *The Art, Science, and Engineering of Programming*, vol. 1(2), no. 18, pp. 18–1–18–23, 2017.

[13] T. Crick, J. H. Davenport, A. Irons, and T. Prickett, "A UK Case Study on Cybersecurity Education and Accreditation," in *Proceedings of 49th Annual Frontiers in Education Conference (FIE 2019)*, 2019, http://arxiv.org/abs/1906.09584.