Reforming England's Key Stage 4 computing qualifications landscape

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Now that the issue of teacher subject knowledge is being addressed through the NCCE, the most significant barrier to giving our children an excellent education in computing is the structure of computing qualifications at Key Stage 4. This green paper proposes changes that would remove this obstacle, and significantly increase the number and diversity of young people choosing computing qualifications at KS4. Our goal is to frame the challenge, promote discussion, and suggest alternative ways forward, rather than to advocate for a specific course of action.

1 The context: a world-leading computing curriculum

England is a world super-power in computing education. We are the only country that (from 2014) unambiguously establishes Computing as a *subject discipline* (not just a vocational skill) that all children should learn from primary school onwards. Establishing an entirely new school subject, as our new curriculum demands, is a huge challenge for schools and teachers. The National Centre for Computing Education (NCCE) is leading the way in teacher professional development, with its courses, teaching resources, pedagogy, all grounded in the best available research.

In short, we have much to be proud of. Other countries look to us to see how to do it.

2 The current qualification framework at Key Stage 4

Huge progress has been made by the NCCE on teachers' subject knowledge and pedagogy, although there is still work to be done. However, progress is now seriously limited by the unintended consequences of the structure of computing qualifications at Key Stage 4.

The current structure caters for the high-performing software developers of the future, but it does not provide a meaningful pathway for student with broader, more applied, interests. As a result, since introducing the new national curriculum for computing, we have gone from 150,000 school pupils taking digitally-relevant qualifications in 2010, to around 80,000 today. This is exactly the opposite direction of travel that we want.

At Key Stage 4 pupils (a full cohort is 600,000 students) can take:

- GCSE Computer Science (about 80,000 students take this, around 13% of the cohort)
- One of a handful of Technical Awards, with titles like "Digital Technologies".

This structure poses many difficulties:

1. **The GCSE in Computer Science covers only part of the curriculum; the more applied parts of the curriculum are not covered**. The GCSE is by-design fairly academic and challenging -- think of it like single-subject history or geography. It's not intended for all pupils, but more than a small minority should be taking it. It needs to be relevant, attractive, and valued.
2. **Computer Science is included within the sciences options block alongside Chemistry, Physics and Biology in the Ebacc.** Given the National Curriculum requirement that students study all three natural sciences, the number of cases where Computer Science counts is marginal. Computer Science almost never appears as a fourth science option, instead it sits in the last open option block alongside music, dance, art, PE, food tech,

and so on. We recognise the policy imperative around the Ebacc and simply draw attention to the fact , while the inclusion of Computer Science in the Ebacc gave a welcome stimulus to the subject, which should not be removed, in practice the Ebacc no longer drives uptake.

3. **Technical Awards may count for Progress 8, but they do not enjoy parity of esteem with GCSEs**. Technical Awards do not count toward the EBacc, a distinction that reinforces their second-class status. Strong students will always take GCSEs instead, and aspirational schools (and parents) will encourage them to do so.
4. **Technical Awards in computing are prohibited from any overlap with the GCSE in Computer Science**. As a result, much of their potential content is eviscerated: they are not really technical at all. An awarding organisation could not offer an exciting Technical Award in robotics, say, with substantial programming content, because it would overlap with the GCSE.
5. **The GCSE in Computer Science is graded more harshly than other subjects**. We have substantial prima-facie evidence that the same student in the same school will get a grade worse result in GCSE CS than in other subjects.
6. **The National Curriculum requirement that all students take Computing at KS4 is almost entirely ignored**. Computing is a "foundation subject", and so is a mandatory part of the National Curriculum Programme of Study at KS4, but there is neither incentive to pursue it, nor sanction for ignoring it.
7. **The gender balance at GCSE and A Level is of grave concern**. Around 20% of GCSE CS candidates are girls, this worsens at A Level to around 12%. The proportion of young women taking a Computer Science course at an HEI is around 17.5%.

In short, we are simply not offering appropriate computing qualifications to our young people and are thus disenfranchising a substantial cohort who would like to take a KS4 computing qualification, but for one of these reasons cannot do so.

This disenfranchisement matters: many careers need rich computing knowledge and skills, *but do not need deep computer science*, including cyber security, IT and network management, digital project management, data management, the games industry, robotics, data science applications, and engineering. Many of these careers lie in the scope of digital T-levels, but there is no KS4 on-ramp to these T-levels.

3 What we can do about it

Happily, the qualifications landscape is something that we can fix without a large central spending programme. It will not be straightforward, and it will take time to do it right, but that just means we should start now. In this section we identify several policy proposals, with different timescales, that would address the challenges set out in Section 2.

3.1 Establish a new GCSE in Applied Computing at KS4

The GCSE in Computer Science covers only part of the national curriculum, leaving computing as the only subject whose GCSE offer does not cover its own national curriculum. Moreover, GCSE CS does not suit all students.

We need a sister qualification in applied computing, addressing the needs of students who are interested primarily in computing and its applications, not in computer science. It would still be rigorous and intellectually challenging; it would contain a substantial element of programming; it would be rooted in the same computer science principles. But it would develop and motivate these foundational elements through concrete applications in graphics, robotics, business data processing, data science, web design, databases, and the like.

Other areas of the curriculum contain multiple related GCSEs, such as Economics and Business Studies. It is hard to see the number of students taking GCSE Computer Science growing much further than its current 15% of the cohort; but a sister applied qualification could attract another 15%. Care will need to be taken that both qualifications are appropriately targeted as Economics and Business Studies are, to avoid simply 'robbing Peter to pay Paul.'

3.2 Remove the non-overlap requirement for computing Technical Awards

A quick win would be to remove the requirement that computing Technical Awards cannot overlap with GCSE Computer Science; in particular, they cannot contain much programming. This prohibition prevents computing Technical Awards from being technical; it eviscerates them. Simply removing this prohibition would allow awarding organisations to develop new, innovative technical and vocational qualifications with substantial computing content.

For example, one could imagine a Technical Award built around web design; or robotics; or virtual reality systems. Freed from the artificial exclusion of technical material from a technical subject, the greater agility of Technical Awards (compared to GCSEs) would allow exciting innovation and provide a (currently missing) on-ramp into T-levels. Awarding Bodies would be free to test the market and respond accordingly.

If the overlap was great, one could prohibit a student from counting both a Technical Award and a computing GCSE towards Progress 8. There is plenty of precedent for such exclusions.

3.3 Refine the subject specification for GCSE Computer Science

The DfE-mandated subject specification for GCSE in Computer Science was written in a hurry, without consultation. It is too detailed, dated, inappropriate in some places, and omits material in others.

The subject specification is overdue for review. This would need to be done carefully; awarding organisations will be reluctant to go through a full redevelopment cycle, and teachers will not welcome changes unless they are persuaded that they are valuable. However, a revised subject specification should help to align the experienced syllabus with the broader aims of the subject, computing and motivate a more diverse cohort.

3.4 Review the grade boundaries for GCSE Computer Science

There is ample evidence that GCSE Computer Science is graded more harshly than other subjects. It is simply unfair that the same student will get worse grades in GCSE CS than they would in another subject. Following a submission from the BSC School Curriculum and Assessment Committee, Ofqual is carrying out a review of grade boundaries. DfE should be engaged in, and supportive of, this review.

3.5 Provide a well-designed passport qualification in digital literacy

Whatever we do, a majority of students will not take a Progress-8-counting computing qualification at Key Stage 4. That majority also deserves our attention. It is inefficient to allow their computing education to just trail off, and it does not equip them for a pervasively digital world in which every future job will require an increasingly complex set of digital know-how. There is ample evidence that employers are not finding these skills in their recruitment pipeline.

We propose that a well-designed, modern digital literacy qualification should be available to all students.

- This qualification should address the breadth and breadth of digital literacy, including, for example, problem-solving, digital communication skills, and moral and ethical choices, not just where to find "bold" in Powerpoint.

- It should be unashamedly focused on employability skills, and what young people need to flourish as well-informed users in a digital world, in contrast to the GCSE which is focused on the subject discipline.
- Students should be able to take it whenever they are ready. For example, schools should be encouraged to offer it: at Key Stage 3 for those who are capable of taking it; within the study skills programmes many schools offer at Key Stage 4; and as part of an enrichment offer for 6th form students.

While such a qualification could not be mandated, it would be welcomed by employers given the universal requirement for digital literacy, and by the HE sector which increasingly depends on students' ability to engage digitally with courses. It would also provide Ofsted with something concrete to consider when inspecting schools' computing curriculum provision.

3.6 Ensure that Key Stage 3 lays the groundwork

The National Curriculum Programme of Study (PoS) for computing is broad and aspirational. But is also brief (only two sides of A4): many schools have interpreted it narrowly, and the back-wash from the current computer science GCSE has led to teaching that is over-focussed on the needs of those planning to take the GCSE. This can encourage pupils who might be attracted by a broader qualification to dismiss computing wholesale, thus reinforcing the diversity challenge.

The NCCE provides practical resources to help teachers teach Key Stage 3 computing well. We recommend complementing these with a DfE-sponsored 'bridging' document that 'unpacks' the PoS into a balanced and consistent set of outcomes which would enable school leaders, teachers, training and support organisations, and other stakeholders including Ofsted and Ofqual and awarding organisations, to get on the same page about what the intended curriculum should and could be in practice.

3.7 Opportunity and risk

One worry about these proposals is that students would simply transfer from GCSE Computer Science to a more applied GCSE, or to a Technical Award, without increasing overall numbers. That is a legitimate concern, but the right path must surely be to provide meaningful qualification pathways with appeal across the whole cohort, and work hard them attractive and well incentivised. Closing off those pathways, as we are doing now, virtually guarantees a low ceiling on the uptake of digital qualifications at Key Stage 4, and undermines the very teachers we are training through the NCCE.

4 Conclusion

Education is complicated, and most problems (behaviour, disadvantage, under-representation of some groups) are hard to address. But with qualifications we are fortunate: the levers lie in our hand, if we choose to pull them.

Changing qualifications is fraught with unintended consequences and other factors such as general inertia in the system will require us to move carefully and thoughtfully. This will take time, but taking no action is also a choice, and it is one that has very harmful consequences.