BCS, The Chartered Institute for IT response to:

Curriculum and Assessment Review - Call for Evidence

November 2024

1. About BCS

1.1. BCS, The Chartered Institute for IT is the professional body for information technology. Our purpose as defined by our Royal Charter is to promote and advance the education and practice of computing for the benefit of the public. We bring together industry, academics, practitioners, and government to share knowledge, promote new thinking, inform the design of new curricula, and shape public policy.

1.2. BCS has over 70,000 members including businesses, entrepreneurs, public sector leaders, academics, educators, and students, in the UK and internationally. We accredit computing degree courses in over ninety UK universities. As a leading information technology qualification body, we offer a range of widely recognised professional and end-user qualifications. We are the leading end point assessment organisation for digital apprenticeships. BCS is the home of Computing at School, our network of computing teachers, academics, and employers which, since its inception has provided support to over 30,000 computing educators.

1.3. Our response to this call for evidence is based on many years of policy engagement with this network. More immediately, in relation to the specific questions asked here, we surveyed teachers, academics and employers within our community, receiving over 300 responses. We also consulted with the BCS School and Colleges Committee (Chaired by Dr. Sue Sentance, Director of the Raspberry Pi Computing Education Centre at Cambridge University) and our England committee (Chaired by Prof. Miles Berry of Roehampton University). The response has been agreed by the BCS Academy (Chaired by Dr. Alastair Irons, Deputy Vice Chancellor and Deputy Principal, Abertay University).

1.4. Our response focuses on two important aspects of the curriculum:

1.4.1. the need to ensure the computing curriculum and its qualifications provide pathways for the specialist (both academic and vocational) and those that plan to enter fields (both academic and vocational) that increasingly depend on a strong understanding of how computing is applied, for example in economics, health, engineering and planning.

1.4.2. the need for all young people to leave with the essential digital literacy needed to make confident, creative, and effective use of technologies and systems, and well-informed critical judgements about the implications and impact of how digital technology is used.

1.5. BCS would be delighted to share potential solutions to the issues we raise following your analysis of the evidence. We recognise that understanding how digital technology, including AI, can be harnessed across the school system to improve outcomes for young people, save teachers time and support school management is out of scope at this stage. We welcome the opportunity to discuss this at the right time.

2. General views on curriculum, assessment, and qualifications pathways

2.1. We recognise the need to avoid placing undue pressure on schools and teachers. Any changes in schools and the wider system should be incremental, and aimed at achieving a longer-term vision and we must raise at the outset the risks associated with a purely subject-based review which does not address the need for coherence across the curriculum. This is particularly an issue for computing which both depends on and contributes to concepts in other disciplines.

2.2. To stimulate growth and serve the needs of young people as citizens, the curriculum and associated qualifications should provide pathways that meet the needs of three overlapping groups:

2.2.1. **Specialist computing professionals**: there is a need for a large, diverse pipeline of computing professionals to enter the workforce as researchers and creators of future digital products and services.

2.2.2. **Professionals in other fields**: capable of making the most of current and future digital products and services; for instance, creating innovative AI solutions to business problems in their sector, with the necessary technical understanding of the opportunities and risks.

2.2.3. **Digitally literate citizens**: which includes the two groups above who can participate fully in a society where IT skills are required to carry out high-stakes tasks such as applying for benefits, jobs, and bank accounts and registering to vote. They should understand the ethical implications of how technology, and their data, are used so they can think critically about the information that comes to them, including news. All young people should leave school digitally literate and able to thrive as informed, effective users of digital technology.

2.3. The school system provides the only mechanism at scale to ensure the necessary supply of digital talent and ensure opportunities are available to all, so it is essential that Computing is kept as a National Curriculum subject studied by all young people.

2.4. BCS defines Digital Literacy as the knowledge, skills and behaviours needed to:

2.4.1. make confident, creative, and effective use of digital technologies and systems, and

2.4.2. make well-informed critical judgements about the implications and impact of how digital technology (including AI and social media) is used.

2.5. Our definition goes beyond the narrow instrumental view that sometimes characterises functional digital skills – it is interesting to note (for example) that the planned digital literacy curriculum in the Netherlands includes AI and data. At present, many young people leave school with no recognition of their digital literacy, meaning they have no way of demonstrating to employers and HEIs that they possess the skills needed for further study. Given the lack of clarity over what constitutes digital literacy (for example, young people believe that they are effective users of social media when they are not) there is a need for the benchmarking of competence that a qualification would provide.

2.6. We set out our views on the extent to which the existing curriculum and qualifications pathways met these needs, together with the evidence that supports those views, in our response to the House of Lords Education for 11–16 Year Olds Committee call for evidence.

2.7. There is much to be proud of. The National Curriculum for computing, introduced in 2014, sets out an entitlement for every learner to access a high-quality computing education. It can equip pupils to 'use computational thinking and creativity to understand and change the world.' However, the programme of study is a short document compared to other subjects, and contemporary topics such as artificial intelligence and big data are not included. There is a lack of context showing the connections between the study of computing and how it can be applied to solve the big global challenges, and there is an overemphasis on abstract computer science which presents the subject independently of the context in which it is practiced at the expense of IT and digital literacy, and key areas of computing such as artificial intelligence and data are not included.

2.8. At Key Stage 4 the needs of all three groups identified above are not addressed coherently, and the qualifications need to be urgently reviewed. A priority is the need to make computing more relevant, responsive, and engaging to encourage wider participation, especially among underrepresented groups.

2.9. Many primary schools have made significant progress in teaching the full breadth of the computing curriculum. Programmes such as Barefoot and the Teach Computing Curriculum have provided valuable support, particularly on the computer science aspects of the subject and primary teachers have invested a huge amount of good will in engaging with this new content. This must not be lost.

2.10. At Key Stages 1 and 2, many schools address the need to teach digital literacy within the computing curriculum and evidence from the CAS community suggests that no changes are needed to the statutory curriculum. However, primary teachers would value guidance on the programme of study that draws out the specific learning objectives in more detail. They would also value guidance on progression and exemplification of what pupils' work looks like in practice in order to set expectations and support assessment.

2.11. Students often begin Key Stage 3 enthusiastic about computing but lose interest over time, particularly in pursuing GCSE Computer Science. This trend is especially evident among girls and students from disadvantaged backgrounds and some students who struggle with programming often feel intimidated and may end up in vocational courses that do not align with their interests.

2.12. In addition, the pressure to provide progression into the specialist GCSE Computer Science and the lack of precision in the programme of study leads to a sterile experience. Applications of IT in meaningful contexts are not addressed and digital literacy receives little attention. For example, the Key Stage 3 PoS has 'undertake creative projects that involve selecting, using, and combining multiple applications, preferably across a range of devices, to achieve challenging goals, including collecting and analysing data and meeting the needs of known users'. Teachers find this sentence opaque. At the same time, other statements in the PoS are granular and devoid on context. The teachers consulted believe that a review of the whole statutory curriculum for computing at key stage 3 is needed to ensure a more balanced and motivational experience.

2.13. The position of computing in the Key Stage 4 National Curriculum is unclear. Given the importance of computing, far greater clarity is needed. While students interested in specialising can take GCSE Computer Science, there is no qualification meeting the needs of potential professionals in other fields. This means that young people can follow a route into retail management, accountancy, health, or public service with only a minimal understanding of the opportunities and challenges of digital technology, and the past few years have provided ample evidence of what can go wrong.

2.14. Digital Literacy is largely ignored at Key Stage 4. This has implications for young people's employability and further study – while Digital Literacy may not form part of a History degree explicitly, sources and materials will be accessed, and work set, submitted and marked through the digital technology, and, of course, many disciplines are being reshaped through the application of digital technology. At Key Stage 4, no single GCSE spans the full range of computing, leaving it as the only subject whose GCSE offer does not cover its own national curriculum. This position needs reviewing. Three-quarters of mainstream state-funded pupils (94% of girls) leave school without a qualification in IT skills or computing having ended their studies at age 14. The curriculum for 11–14-year-olds is distorted by the need to prepare a small number for a specialist route, especially given the lack of clarity in the Key Stage 3 Programme of Study.

2.15. To ensure students enter Key Stage 5 with foundational digital skills, it would be beneficial to establish a mandatory digital skills curriculum at Key Stage 4. Introducing a qualification, such as a GCSE short course in computing that could be taught in one hour per week, would set clear expectations for digital competency across all students. This model mirrors the existing short-course options in subjects like PE and Religious Education, offering focused but manageable coverage within the curriculum. However, the current variability in digital skills education at Key Stage 4 poses a challenge to such a rollout. Any initiative at Key Stage 5 would first require consistent standards and adequate provision at Key Stage 4 to ensure all students have the requisite skills before advancing.

2.16. A-Level Computer Science is perceived as a niche subject, with low enrolment despite its potential to provide a foundation for STEM and other disciplines. We are also concerned about the binary choice between academic and vocational pathways, which can limit students' options based on misconceptions about the value of different qualifications. BTEC provides a valuable route.

2.17. The way the A-Level non-examined assessment is implemented continues to impose challenges. The focus should be clearly on programming. The onerous requirement for documentation means that many students struggle with the weight of NEA marks relative to the effort spent on writing up rather than creating their solutions, leading to concerns about time management and too great a focus on theoretical learning.

2.18. Finally, schools struggle to recruit computing specialists and time constraints impact on teachers' ability to extend their subject knowledge and pedagogical skills, creating a tension between providing computing for all and the specialist route. Shortages in England create significant variation in students' access to the GCSE. In 2020-21, 72.6% of comprehensive schools offered it, compared with 92.6% of grammar schools. Under 75% of the recruitment target for initial teacher has been met in the past five years. Schools cannot compete with salaries in other sectors, so a traditional view of recruitment will not work.

2.19. We recognise that this is outside the scope of the current review, but we would make two points. Firstly, our aspirations for young people should not be constrained by staffing challenges which could be addressed through exploring 'braided' careers, training non-specialists, centralised remote specialist teaching, and promoting the intrinsic rewards of teaching computing. Secondly, curriculum change is not simply a redrafting exercise, it is a change management programme. It was the failure to grasp this simple point that led to many of the issues we have identified.

3. Social justice and inclusion

3.1. Computing can offer a ladder out of disadvantage for young people, particularly those who are the first in their family to go to university, and the high demand for computing skills at all levels opens up real opportunities. However, evidence from the CAS community emphasises the disparity in access and engagement with computing education, particularly affecting students from disadvantaged backgrounds. Schools in poorer areas are less likely to offer GCSE Computer Science, with students from these backgrounds also facing challenges such as limited access to devices and internet connectivity. This digital divide restricts students' ability to practice outside school, exacerbating inequalities as digital assessments become more prevalent.

3.2. The Office for National Statistics estimates that one in five children across the UK experience digital poverty, which significantly impacts their engagement with computing courses. Primary schools have inconsistent resources, with some able to offer a range of devices while others struggle to meet curriculum requirements, underscoring the need for investment in basic technology to create a more level playing field. Ethnic disparities also exist in computing qualifications, and these are complex in themselves requiring a more care when interpreting the data as categories are used inconsistently, and there are issues of intersectionality. Again, the interplay with gender is complex. BCS has worked closely with groups actively supporting learners who are currently not engaging and would be delighted to share our experiences with the review group.

3.3. Students from disadvantaged or underrepresented backgrounds often require traditional, recognised qualifications, like A-Levels or BTECs, to advance in education and careers. However, these students are less likely to attain the necessary GCSE grades for A-Level courses, limiting their options to qualifications, which many universities still hesitate to accept. In the competitive apprenticeship market, qualifications remain a significant barrier, perpetuating disadvantages for these students.

3.4. There are significant and substantial gender disparities in computing education. The removal of GCSE ICT created an imbalance in uptake of qualifications, and while the situation has improved, the current curriculum heavily favours aspects typically preferred by boys, with limited focus on elements that might appeal to girls. White girls and Black boys are the least represented groups in GCSE Computer Science, suggesting cultural factors may influence this gap.

3.5. In primary schools, girls show enthusiasm for computing, and the cross-curricular, hands-on approach—often modelled by female teachers—helps counter gender bias. However, by Key Stage 3, many girls lose interest, a trend that continues into further education and professional fields. Evidence suggests that girls are more motivated by the potential for social impact within computing than by its technical aspects, underscoring the importance of a relevant, inspiring curriculum that appeals across genders. A Belgian study presented 190 14-year-old boys and girls with IT, statistical and scientific concepts in both the standard masculine contexts and in standard feminine contexts. Girls' interest in IT topics significantly increased when they were presented in the feminine rather than standard contexts. This further supports the need to review the Key Stage 3 computing curriculum.

3.6. Addressing these gaps requires a bold commitment to updating resources, creating inclusive curriculum pathways, and ensuring that computing education remains relevant and engaging throughout all educational stages.

4. Curriculum and qualification content

4.1. The responses to our own consultation highlighted the need for a balanced approach in the curriculum that integrates practical skills with academic content. In particular, the over focus on the mechanics of computer science devoid of any connection with its practice in real contexts and the lack of any reference to AI or data analytics is dated and does not recognise how real applications are developing. AI in particular creates a new paradigm for developing software and we do not serve the students, society or the economy well if we only focus on a procedural/algorithmic approach.

4.2. The lack of a general qualification in digital literacy and the modest take up of the GCSE in Computer Science and related vocational qualifications means that most students leave school without any formal means of demonstrating their capability. Digital literacy has long been recognised as essential for employment. It was identified as a core skill alongside literacy and numeracy by the CBI as early as the 1990s. However, in contrast to literacy and numeracy, where most young people sit a qualification, and are required to resit if they do not achieve the government mandated level of achievement, there is no qualification that employers, HEIs or training providers can use to assess applicants' digital literacy. This has profound implications, particularly given the wide range of views on what is a satisfactory level of competence. A qualification, aimed at all young people would provide all stakeholders with much need clarity.

4.3. There is a lack of continuity between GCSE and A-Level computer science, often leading to a fragmented curriculum experience. To address some of the social justice points raised above, decolonization efforts, increasingly emphasized in higher education, could be extended to schools by broadening the scope of computing and the GCSE in computer science to include more social and ethical perspectives. This shift might improve inclusivity by addressing engagement disparities among students of various gender, ethnic, and socioeconomic backgrounds.

4.4. Teacher expertise and confidence in subject knowledge are crucial. Clearer career pathways and stronger links with tertiary institutions are needed to support teacher development. In addition, the importance of cross-disciplinary learning where students draw on their understanding of computing in other subjects could deepen digital literacy and enhance overall learning.

5. A broad and balanced curriculum

5.1. A great computing education should also foster critical thinking and global citizenship, helping students to evaluate diverse information sources and engage with global issues. This approach would better equip them to address 21st-century challenges as responsible, informed citizens. The current curriculum focuses on subject knowledge. Subject knowledge is of course important, but it is insufficient. In programming it is important (for example) to know what different programming constructs do, but it is equally important to develop the design skills which a programmer uses to identify when and how to use different constructs when producing a solution. It is equally important that computing takes place in a context – programmers shape how we run our lives and plays a part in the creative process of designing and developing digital products, alongside other skills. Programming is a 'practice' and it is essential that those learning this practice do so recognising the contexts in which they operate and how the practice is changing through new approaches to software design using AI/machine learning drawing on large data sets with all the opportunities and risks that implies. This is particularly an issue in secondary schools.

5.2. The breadth and balance of the experienced curriculum is directly impacted by the measures used to hold schools to account. For example, in Year 6, the focus on KS2 accountability often distorts the learning experience, limiting time for computing. In secondary schools, The debate over the EBacc's role persists, with some suggesting that relying on Progress 8 (P8), which includes a broader range of qualifications, could provide a more balanced approach. This is explored further in our response to the section on accountability measures.

5.3. There is also a call for integrating digital literacy within other subjects, ensuring students can apply technological understanding across various fields. While we recognise the need not to overburden teachers, the teachers we consulted noted the growing demand for media and data literacy within the English and Mathematics curriculums. In English, teachers express a strong interest in expanding digital media literacy, as noted by recent surveys from media literacy organizations. In Mathematics, the topics of probability and statistics have become increasingly relevant due to the influence of machine learning and AI in society, where data literacy is increasingly becoming a core competency. While this may be out of scope for this review, it is worth noting that teachers' digital literacy was removed from the standards for teacher training early on by the previous government, leaving many teachers struggling with remote teaching during the pandemic and unable to capitalise on reductions to their workload offered by AI.

5.4. At the post-16 level, opportunities for a mixed qualification approach have narrowed, as students increasingly focus on three A-levels or commit fully to a T-Level, which, unlike BTECs, does not allow for a combined study option. Additionally, discussions on the concept of "creative" subjects indicate ambiguity about what skills or disciplines this term encompasses.

6. Key stage 4 Technical Awards

6.1. We have reviewed the content and take up of technical awards in computing across the four countries of the UK and believe the curriculum review should consider the contrasting approaches adopted in the different UK nations, as some appear to have achieved a better balance between academic and vocational pathways and between specialist and universal qualifications. For example, Northern Ireland is creating a single digital technology qualification grouping, recognising the technical and creative tracks this may lead to. Others seem to be tackling the issue from the perspective of a tighter definition of Computer Science / Computing Science, with the curriculum and qualifications in England looking more tightly linked to this approach than elsewhere. The over-focus on Computer Science is referred to earlier in our response.

6.2. The scale of uptake of Vocational Technical Qualifications (VTQs) across the four nations in general is small (and reducing) by comparison with the numbers taking more academic options and many of the large number of awards available are arguably quite niche. All of the UK nations have a long-standing problem with the balance of male:female participation in whichever variant of the subject they are teaching and whether in academic or vocational domains. This reinforces the earlier points about gender inclusion and social justice.

6.3. There is a strong perception that technical awards are subject to a no-overlap rule with the Computing KS3 Programme of Study and the Computer Science GCSE subject specification. As a result, technical awards do not include the technical content needed for further progression. However, this needs investigation as the source and accuracy of this perception is not clear.

6.4. The loss of any computing-rich options beyond key stage 3 (KS3) in England other than GCSE Computer Science causes concern and there is little to suggest that VTQs are currently seen as alternatives being effectively promoted as options or complements to the current system. This supports the argument for a Digital Literacy qualification made in Section 4.

7. Secondary assessment

7.1. The national position on computing education is confusing because of the potential misclassification of ICT and computer science lessons in national data collection on school timetables, leading to inconsistent reporting and possibly misleading data on computing education.

7.2. The removal of ICT qualifications like GCSE and A-level ICT, as well as technical awards such as the European Computer Driving Licence (ECDL), has significantly reduced qualification options and computing hours at KS4. This decline emphasizes an urgent need for a review of computing qualifications at this level to ensure they meet educational needs and align with schools' incentives to offer a well-rounded computing education.

7.3. The current GCSE in Computer Science is theoretical and demanding, emphasising recall of knowledge rather than application, and not serving the subject well. Much of the content, such as CPU functionality and fetch-decode-execute cycles, is abstract and challenging for students, overshadowing practical exposure to emerging technologies like AI. We support the views of many computing teachers who advocate for a broader, more inclusive computing qualification that encompasses a wider range of digital skills beyond traditional Computer Science. This could address underrepresentation of girls in the subject by aligning the curriculum more closely with diverse student interests, building on the digital foundations laid from KS1 to KS4. Such a qualification should ensure pathways to advanced computing studies remain accessible by providing a strong foundation in computing fundamentals, so it would still facilitate entry into A-level and beyond, without strictly requiring a narrow Computer Science GCSE.

7.4. A significant challenge in computing education is the sharp divide between vocational and academic qualifications, which forces students to choose between GCSE Computer Science and vocational media courses, with limited overlap. This contrasts with subjects like food technology, where both GCSE and vocational options exist and cover similar skills from varied approaches. For students interested in the 'professionals in other areas' pathway, the lack of a middle-ground qualification can lead them towards vocational pathways that may not support their aspirations for higher education.

7.5. Teachers and students believe with some justification that getting a good grade in GCSE Computer Science is harder than in other subjects, making the GCSE unattractive for school leaders. This falls far short of the robust pipeline of future specialists needed for an economy increasingly dependent on a supply of those specialists. BCS's analysis submitted to the Treasury using GCSE Physics as a benchmark to model an effective pipeline estimated that the number of candidates taking the specialist pathway needs to more than double to meet employers anticipated demand.

7.6. The most authentic way to assess candidates' practical application of their knowledge and skills is through creating real programs. At the moment, it is possible to pass the GCSE Computer Science course whilst doing very little (if any) programming on a computer. A recent survey (Hadwen-Bennett & Kemp, 2024) found that 37% of teachers would increase lesson time dedicated to programming if the exam required on screen programming.

7.7. Practical assessments, such as on-computer exams, would better represent students' programming skills and align with real-world applications, encouraging teachers to integrate more hands-on programming tasks alongside theory. The curriculum and assessment review should encourage awarding bodies and others to explore how technology can be used to manage candidates' practical work over periods to ensure its provenance.

7.8. Finally, a YouGov poll of parents commissioned by BCS revealed a wealth of parental support for all young people taking a qualification that recognised their digital literacy. It is the design of existing qualifications which make them unappealing to students and the structural issues created by accountability measures that prevent this.

8. Accountability

8.1. There is growing support amongst some members of the CAS community for reforming the current GCSE framework, with some suggesting a full departure from GCSEs, which may no longer hold value beyond serving as a "ticket" to students' next educational phase. However, we recognise that this is an issue that requires significant consideration and is outside the scope of this review.

8.2. Specifically, in GCSE Computer Science on any future GCSE in Computing, there is a need to rethink assessment, moving away from written exams and towards assessments that incorporate practical programming tasks. Current exams often disadvantage students with strong programming skills by testing their reading comprehension and memorization under time pressure rather than their coding abilities, resulting in some students leaving higher-mark questions blank. High-stakes, written exams also discourage skill-building activities, such as teamwork and project-based learning, which are crucial for working in the IT industry, which applies specific methodologies to the team development of solutions. The emphasis on standardized testing has shifted assessment from teacher judgment toward rigid, external metrics, prioritizing test reliability over meaningful skill development. Earlier in our response we identified on-screen assessment as a means of addressing this issue.

8.3. The EBacc framework has narrowed subject options for students at KS4, often sidelining "hard" subjects like GCSE Computer Science in favour of subjects with higher average performance outcomes. This shift has influenced how schools approach high-stakes assessments, with a focus on knowledge recall over practical competencies. GCSE Computer Science sits alongside the compulsory natural sciences in the EBacc. As the National Curriculum requires the teaching of the three natural sciences at Key Stage 4, Computer Science tends to be offered in the more general subject option where it competes with art and design, D&T, a second humanity or language, business studies, RE etc. Simple modelling by BCS reveals that this constricts candidate numbers so meeting the numbers of specialists needed cannot be achieved within these constraints without seriously damaging creative and other subjects. In effect the constraints of the EBacc limit growth. We have considered a number of ways of addressing this and would welcome further discussion on this issue. At this stage we simply note that freeing up schools does not place additional burdens on them.

8.4. Additionally, some of the employers responding to our consultation feel that GCSEs have become more relevant to school performance metrics than to the individual student. This emphasis on exam results often overlooks other essential aspects of education, such as arts, sports, and community involvement, which contribute significantly to a well-rounded experience. Broader measures of accountability should take these non-exam-based accomplishments into account, recognizing the full scope of a school's contribution to student development beyond academic grades alone.

9. Qualification pathways 16-19

9.1. The narrowing of post-16 qualification pathways, the defunding of BTEC courses and the uncertainty over Alternative Academic Qualifications limits students to either A-Level or T-Level pathways. While A-Levels are more academic-focused, T-Levels offer specialized career alignment, but not all schools can provide a range of options, which may restrict students' choices for aligning studies with future career or education paths.

9.2. At present, the requirements for vocational qualifications to map onto specific pathways precludes the development of suitable entry level and Level 1 qualifications as skills at these levels are generic. Young people working as retail assistants, receptionists, stock controllers, mechanics and delivery drivers all need basic IT and digital skills.

9.3. Again, the need for the appropriate level of digital literacy needs to be addressed at 16-19. Higher education has been transformed following the pandemic. A student with A levels in English, History and Politics, who last studied computing at age 14, may well find herself on a History degree where work is created as a word processed document, drawing on sources located through online research portals, set, submitted and marked on a learning platform, demanding a minimum level of digital literacy for study at this level.

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