Removing the duty on maintained schools to follow the information and communication technology (ICT) Programmes of Study, Attainment Targets and statutory assessment arrangements

A consultation response to the Department for Education by the Next Gen Skills campaign

April 2012

next gen. SKILLS

Executive Summary

Next Gen Skills is a major campaign formed from an alliance between the biggest names from the UK digital, creative and hi-tech industries and the UK's leading skills and educational bodies to improve the computer programming skills needed for the future growth of the UK's economy.

The Next Gen report[1] and the Next Gen Skills campaign[2] were established to ensure that the flow of high calibre talent from education to industry is enhanced in the United Kingdom. The Next Gen report set out how we can transform the UK once again into the world leader for providing digital natives that have the skillsets across a wide variety of industry sectors including but not limited to marketing and communications agencies, mobile hardware and software providers, technical and digital agencies, broadcast providers and the video games and visual effects industries. Since the launch of the Next Gen Skills campaign in November 2011, the relevance of our campaign has been grasped even further afield, from design through to advanced manufacturing, electronic engineering and pharmaceuticals. We believe that increasing the number and quality of computer science graduates is now fundamental to the public policy goal of promoting growth in our hi tech economy more generally. We therefore strongly argue that policies to implement this objective should be the outcome of the current review.

Every child should learn the concepts and principles of ICT and Computer Science from primary school age onward.

We believe that every child should learn the concepts and principles of Information and Communication Technology (ICT) and Computer Science from primary school age onward, and later have the opportunity to specialise in Computer Science if they wish. Computer Science should be recognised as a fully-fledged scientific subject, to be taught in school on a par with other scientific subjects. Like the other sciences, it will have a practical as well as a conceptual aspect and can be taught alongside compatible subjects like Maths, Physics, Art or Design. It is crucial that government, industry and educators alike share this common purpose and work together to implement policies which makes this a reality.

Our consultation response is the product of engagement with our campaign members from January to April 2012 and a consultation seminar with head teachers and ICT teachers on 20th March run in conjunction with The Education Foundation (referred to below as "the Curriculum Group"). Our response has been developed in conversation with other campaign members who have also submitted individually. We have also reflected the major contribution of the Royal Society report[3] in January 2012, especially with regard to the issue of teacher training and support, and evidence from other countries, notably Israel.

Key recommendations

1. Next Gen Skills agrees that the current ICT Programme of Study, statutory attainment targets and KS3 assessment arrangements should be replaced in order to introduce a new curriculum which includes Computer Science. While the replacement of the current Programme of Study is supported, the dis-application of the Programme of Study and Attainment Targets carries significant downsides which must be addressed by Government, industry and educators in response to this consultation.

2. HM Government should set out a Vision for Computer Science, akin to the ambition in the Henley report on Music, outlining the proper role for government and industry in achieving outcomes.

   > *"Every child should learn the concepts and principles of Information Technology and Computer Science from primary school age onwards, and later to specialise in Computer Science if they wish."*

3. If the statutory Programme of Study and Assessment is dis-applied then the Department for Education (DfE) must build assurance by establishing a short, medium and long term 'Route Map' to Computer Science from September 2012 to September 2014 and beyond. The Route Map, developed with industry, should include the following key principles:

1 - NESTA, Next Gen: Transforming the UK into the world's leading talent hub for the video games and visual effects industries A Review by Ian Livingstone and Alex Hope (2011). http://www.nesta.org.uk/library/documents/NextGenv32.pdf

2 - Next Gen Skills is an alliance between the biggest names from the UK digital, creative and hi-tech industries and the UK's leading skills, professional and educational bodies to ensure the UK can out-educate every country on earth when it comes to Computer Science, so the UK, like the US, succeeds as a global technology leader. The campaign is led by games and interactive entertainment trade body UKIE (including major international companies with UK interests such as Microsoft, Sony, Nintendo, EA, Activision and SEGA, plus leading UK creative development studios such as Blitz Games Studios, PlayGen and The Creative Assembly). Other supporters include Google, TalkTalk, Facebook, the British Screen Advisory Council, Guardian Media Group, the Design Council, Intellect, IPA, British Computer Society, Abertay University, Creative Skillset, GuildHE, E Skills, the Education Foundation, NESTA and UK Screen (representing some of the world's leading visual effects businesses, including Oscar winners Double Negative and Framestore). www.nextgenskills.com

3 - Royal Society, Shut Down or restart: the way forward for computing in UK schools (January 2012). Chapter 7

- Computer Science should be (re) established as a rigorous, high-status school subject discipline, on a par with Maths, Physics, or History.

- The importance of Computer Science should be recognised by incorporation within the English Baccalaureate.

- With industry, professional bodies, schools and universities the DfE should set a target ambition for Computer Science in schools by 2015 (e.g. half of all schools teaching Computer Science in three years).

- This goal should be pursued with industry through both formal channels (the school curriculum and qualifications) and informal ones (e.g. after school clubs, hack spaces, hobbyist learning).

- Adequate investment should be secured to train / re-train a new generation of Computer Science teachers.

- Introduce benchmarking of new Computer Science courses against agreed Fundamental Principles developed with professional bodies, industry, universities and schools. This would enable educational outcomes from new Computer Science curricula to be rigorously evaluated.

- Create a national Network of Computer Science Teaching Excellence to co-ordinate resources between schools, industry, professional bodies and universities. Such a body could assist DfE on benchmarking and improvement along the lines of similar structures in Mathematics or where Computer Science programs have been successfully implemented, e.g. Israel.

Introduction

Across public policy the Coalition Government has grasped the importance of skills for the new digital economy and exhibited strong leadership, support and direction to new initiatives promoting hi tech growth. The Government has been keen to drive the digital and hi tech economy through its investigation of the link between Intellectual Property and Growth[4]. Heavy emphasis too has been placed on supporting the UK's research and development[5]. The Prime Minister has recognised the potential of 'Hi Tech Britain'[6], reflecting the growth and innovation of London's Tech City and other digital clusters. Even in the public sector, the work of Race Online 2012[7] on digital inclusion and the Government's 'Digital by Default' agenda sets out a clear vision for the empowerment of citizens and the reform of public services[8]. The final piece in the jigsaw linking all of these different visions is how skills which help us understand, use and create digital products have become central to our competitiveness – a point reinforced by high level industry interventions[9].

Across public policy the Coalition Government has grasped the importance of skills for the new digital economy

As in other countries, lack of understanding of the disciplines of ICT and Computer Science and their place on the curriculum have been exacerbated by general misconceptions about Computer Science characterised either solely as the teaching of computer programming or, at the other end of the spectrum, computer literacy. A further approach has been to see computer skills as something to be mainstreamed in other studies[10]. The subsequent perception gap, that ICT or Computer Science are not fully fledged subjects, is also reflected in diverse opinions on what the subjects are called[11].

The UK is not alone in readdressing ICT and Computer Science, and we can learn much from other jurisdictions over the last two decades because of shared experiences. In the UK, as in Europe and the United States, the development of Computer Science in the curriculum saw a significant shift away from the teaching of the basic principles of computers with the advent of the PC and new software technologies during the 1980s and 1990s[12]. As a consequence a number of countries have drifted away from the more theoretical principles of abstraction and algorimisation, which underpin how computers actually work, and towards a

4 - Intellectual Property Office, Digital Opportunity: A review of Intellectual Property and Growth (IPO, June 2011) www.ipo.gov.uk/ipreview-finalreport.pdf

5 - Rt. Hon. David Willets MP, Our High tech Future (4 January 2012). http://www.bis.gov.uk/news/speeches/david-willetts-policy-exchange-britain-best-place-science-2012

6 - 10 Downing Street, PM announces East London Tech City (4 November 2010). http://www.number10.gov.uk/news/pm-announces-east-london-tech-city/

7 - www.raceonline2012.org

8 - Cabinet Office, Directgov 2010 and Beyond: Revolution Not Evolution: A report from the Digital Champion Martha Lane Fox with recommendations for the future of Directgov sent to the Minister of the Cabinet Office Francis Maude (November 2010). http://www.cabinetoffice.gov.uk/resource-library/directgov-2010-and-beyond-revolution-not-evolution

9 - Eric Schmidt, "Britain's economy will thrive if computing becomes child's play" (Observer, 8th April 2012) http://www.guardian.co.uk/commentisfree/2012/apr/08/eric-schmidt-improve-computer-education?CMP=twt_gu

10 - Computer Science Teacher Association, High School Education in Computer Science (CSTA, 2005). www.csta.acm.org/Communications/sub/.../White_Paper07_06.pdf

11 - Royal Society, Shut Down or restart: the way forward for computing in UK schools (January 2012). Chapter 1-2.

12 - Computer Science Teacher Association, High School Education in Computer Science (CSTA, 2005). www.csta.acm.org/Communications/sub/.../White_Paper07_06.pdf

more practical informatics-focused curriculum[13]. This has led to our current policy dilemma, where children are taught how to use software, but not how to create it[14].

In the UK there is now a significant body of work from industry and professional bodies which has provided the evidence and momentum to readdress Computer Science on the curriculum. Computer Science should now be seen as a high status discipline in its own right[15] with clear application for the digital economy as a whole. The Government response to this consultation is therefore a crucial moment for policy makers to recognise the centrality of computing to the pursuit of other disciplines and careers: Computer Science supports economic well-being at the personal (intellectual), vocational (employability), social (stronger work force) and national (more competitive market force) levels.

An observation by one school governor made to us applies equally to individuals as it does to UK competitiveness:

> *"If you don't know about software you can't really participate in the technologies that dominate our lives. Computing is a fundamental technology much more like writing. Students need to be able to read and write and need to know how to instruct machines to do things. Of course you can get by without understanding or participating, but you're stuck in the past - a bystander."*

1a) Do you agree with the Government's proposal that the statutory Programmes of Study for ICT should be dis-applied in maintained schools in England from September 2012?
1b) Do you agree with the Government's proposal that the statutory Attainment Targets for ICT should be dis-applied in maintained schools in England from September 2012?

Next Gen Skills agrees with the proposition that the current ICT Programme of Study, statutory attainment targets and KS3 assessment arrangements should be replaced in order to introduce a new curriculum which includes Computer Science. The Government could achieve this by creating a new Programme of Study or by removal and replacement with the proposed 'decentralised curriculum' suggested by the Secretary of State at BETT[16]. While the Secretary of State intends for a potential new curricula to be flexible ('wiki curriculum' concept), it should be noted that the basic principles of the science of computing, algorithm and its use in computing systems, have remained constant despite the advent of new technologies. As such it is possible to set and benchmark curricula against core or fundamental principles and practices of computation and computational thinking. In either case new programme(s) should be carefully thought out and based on the accepted key concepts and foundations of the field.

If you don't know about software you can't really participate in the technologies that dominate our lives.

In order to create the necessary space in the school curriculum for a modern computing curriculum, Next Gen Skills would agree with the above proposal with a number of important caveats and recommendations which we consider critical to the success or failure of this change in approach. From evidence we have received we are concerned that outright disapplication carries a number of unintended consequences, discussed in our answer to 2, below, which need to be mitigated by the recommendations set out in response to Question 3.

Next Gen Skills firmly believes that the Department should minimise the risk of some schools misinterpreting this as a tactical retreat from ICT, to the detriment of Computer Science and digital skills as a whole. We are particularly concerned that without a clear vision on Computer Science from Primary school onwards this could occur in the period between the withdrawal of the Programme of Study in September 2012 and the introduction of the new National Curriculum in September 2014. There is some evidence from the academy sector that where schools have the opportunity to choose not to provide the ICT Programme of Study, the most common change is to stop providing ICT or design technology at Key Stage 4 – using time for modern languages and, only in some cases, Computer Science[17]. Any uncertainty caused by the removal of statutory assessments and attainment targets must be addressed by the 'Route Map' model set out in 3(b), below.

13 - J. Gal-Ezer, C. Beeri, D.Harel, A. Yehudai, A High School Program in Computer science, (IEEE, 1995).

14 - Ian Livingstone, Teach Children Computer Programmes (Guardian, 11 January 2012). http://www.guardian.co.uk/commentisfree/2012/jan/11/teach-children-computer-programmes

15 - Royal Society, Shut Down or restart: the way forward for computing in UK schools (January 2012). Chapter 3.

16 - http://www.education.gov.uk/inthenews/speeches/a00201868/michael-gove-speech-at-the-bett-show-2012

17 - Plan A+: unleashing the potential for Academies (Reform, March 2012) http://www.reform.co.uk/pages/4441/view

Turning to the disapplication of the statutory Attainment Targets for ICT from September 2012; while we agree with the general policy objective to make the current curriculum more flexible, the removal of the current framework will make it much more difficult to assess the rigour of the new curricula in schools and, most importantly, which interventions are needed to improve teaching and learning. Next Gen Skills therefore recommends that the DfE enables the benchmarking and rigorous evaluation of new Computer Science courses against agreed principles developed with professional bodies, industry, universities and schools (see below). Finally, it will be important for OfSTED inspectors to understand this changing landscape and changes need to be built into the accountability framework for them to work effectively. OfSTED, industry and professional bodies should work together to ensure that there is an appropriate assessment regime to ensure rigour and improvement.

1c) Do you agree that the statutory assessment arrangements for ICT at Key Stage 3 should be dis-applied in maintained schools in England from September 2012?

As a matter of public policy Next Gen Skills believes it is important to formally assess pupils' 'digital literacy' during Key Stage 3 as we believe all pupils must be digitally literate before they leave school. Assessment at Key Stage 3 gives a clear direction of travel in the education system for primary school learning through to GCSE and beyond. We are concerned if DfE do not attempt to measure how many pupils have achieved this basic literacy during Key Stage 3 there is the danger that a significant proportion of pupils will not receive the remedial attention they require before they start Key Stage 4. Again, should the DfE wish to replace the current regime we request that firm direction of travel be developed via a 'Route Map' to guide change.

2a) What would be the likely impact in schools of dis-applying the existing Programmes of Study and Attainment Targets?

With the right support decentralising the Computer Science curriculum could create a true opportunity for schools and industry to innovate. The issue is well put by one Curriculum Group member: "we are entering into a period of 'exciting anarchy' over the curriculum. What are the levers and incentives to make these changes work?" Next Gen Skills is keen to explore this question, and there should be a central role for industry in achieving the goal of making Computer Science a much more high-status and mainstream discipline than it has been in our education system.

We caution that disapplication does not come without some general risk to technology teaching in schools. While we support the replacement of the current Programme of Study, the disapplication of the Programme of Study and Attainment Targets carries potential downsides which must be addressed by Government, industry and educators in response to this consultation.

Chief among these risks is the perception among school leadership that ICT can be integrated into the teaching of other subjects or removed entirely from the curriculum to make way for other assessed subjects. Without appropriate discussion around direction, accepted principles, benchmarking and leadership the risks are that some schools may withdraw from ICT (and Computer Science) because the subject is not fundamentally seen (or assessed) as part of what makes a school successful.

Pupils must be digitally literate before they leave school.

The fear of tactical retreat was very pronounced among our Curriculum Group. Teachers feared the creation of an immediate "vacuum" by removing the statutory Programme of Study: put more starkly "the DfE haven't created opportunity, they have created a black hole." Anecdotal evidence also suggests that school leaders have interpreted the consultation as a signal to end ICT provision altogether. Without further support and general leadership "there is a danger of [ICT and Computer Science] being a Dodo subject."

The Next Gen Skills / Education Foundation seminar charted out some possible likely impacts across schools ranging from:

- Do nothing different (carry on with existing Programme of Study)
- Do nothing at all (or perhaps re-energise current provision)
- Develop a compromise solution – active or negative
- Take a radical approach to ICT and Computer Science (some schools lead practice which risks potential challenge from OfSTED unless steps are taken to improve inspection)

The relative youth of computer science as a discipline creates distinct dynamics in a decentralised curriculum structure. For example, the push of parent power, so important with a bottom up approach is likely to be much weaker in a new subject like Computer Science than in more traditional subjects, where parents will have expectations on quality of teaching and materials taught. This may result not only in poor take-up of the new subject at primary and secondary schools, but also weak parental challenge around rigour and course horizons. This was reflected by our curriculum group: "Although all parents want their kids to learn how to create software, they have no idea how that's done - so can be fooled by poor provision with limited content."

Computer Science in the UK suffers from a major gender imbalance

By the same token, identifying the appropriate Computer Science curriculum among the many on offer poses specific challenges to school leadership, creating a demand for external support and validation among leadership teams lacking knowledge about ICT and Computer Science. It is therefore imperative that head teachers and governing bodies buy into the changes and are given adequate support to do so.

2b) How might this vary between different types of school or differentially affect different groups of pupils?

Our Curriculum Group suggested that there is a significant risk that disapplication will have different impacts across different types of schools. A central question is how ICT and Computer Science fit together. The aim of Next Gen Skills is to introduce an industry relevant Computer Science course within the framework of the National Curriculum. The flexibility of new courses may mean that schools will differ in the relative emphasis they wish to give to ICT and Computer Science, depending on the learning needs of their students.

Calls for a 'dual stream' approach for students of varying levels of achievement and interest were also echoed elsewhere during the consultation process.[18]

Ideally the flexibility proposed by the disapplication will allow for greater innovation in course design, potentially allowing for pupils of varying abilities enough time and immersion to choose their own path, whether in elements of pure computer science or computer science as it relates to disciplines like design or art. Following Recommendation 6 of the Royal Society report, a much wider range of GCSEs than at present would be very desirable – ranging from an unashamedly academic GCSE in Computer Science at one end, to a more applied and vocational KS4 qualifications in IT at the other, with possible intermediate points for qualifications such as Systems Administration, Web Development or Creative Multimedia. This could create the opportunity for schools to specialise or to offer students a wider range of learning through clustering and collaboration.

The Royal Society recommendation reflects experience elsewhere. For example, the Israeli curriculum has developed two different programs to introduce students at varying attainment levels. The first is for students with only a general interest in ICT and Computer Science, while the second, for those with a specific interest, is a deeper and broader course[19].

In the UK, as well as elsewhere, Computer Science suffers from a major gender imbalance. Computer Science has the biggest gender gap in A-level students of any STEM subject, with 92.5% of A-level entries in 2011 being male, a finding constant from 2002 onwards[20].

Next Gen Skills is also concerned about any other manifestation of a digital divide on socio-economic background. False perceptions by adults of this generation of children being innately technology-savvy should not cloud the need to teach the fundamental principles and skills we refer to above. Digital exclusion, particularly in coastal or rural areas and in more deprived inner city areas remains high, with penetration of PCs lower among social groups C, D and E. Ultimately if we cannot source talent from the biggest possible pool the economy will be held back if computer science is seen as elitist or only open to the few. We therefore suggest specific calls to action for industry, schools, local authorities and central government to address this issue.

18 - V3, Government urged to split IT GCSE into specialist and general courses (27 March 2012) http://www.v3.co.uk/v3-uk/news/2163965/government-urged-split-gcse-specialist-courses

19 - J. Gal-Ezer, C. Beeri, D.Harel, A. Yehudai, A High School Program in Computer science, (IEEE, 1995).

20 - Royal Society, Shut Down or restart: the way forward for computing in UK schools (January 2012). Chapter 3.

3a) Do you agree that schools should be encouraged to deliver a more challenging, rigorous, discipline-related curriculum in ICT, especially by focusing on the foundational principles and practices of Computer Science?

The Next Gen Skills campaign fully supports this objective and makes a number of recommendations for areas of work to ensure this become a mainstream reality in schools.

A Vision for Computer Science

The unequivocal view from Next Gen campaign members and our Curriculum Group was the need for an official indication of the importance of Computer Science in our education system, by expressing a Vision for Computer Science akin to the ambition in the Henley report on Music. In order to equip the UK economy for the 21st century:

> *"Every child should learn the concepts and principles of Information Technology and Computer Science from primary school age onwards, and later to specialise in Computer Science if they wish."*

A high status subject in the English Baccalaureate

A key incentive for schools will be knowledge of the importance attached to Computer Science by the DfE and its standing in relation to other subjects. Next Gen Skills therefore argues that Computer Science should be incorporated within the English Baccalaureate as a rigorous, high-status school subject discipline, on a par with Maths, Physics, or History.

Underlying Principles as 'strong bones' of new learning
The National Curriculum Expert Panel recommended computer science in secondary schools be "properly considered."[21] While disapplication means that learning will not be prescribed (as 'core' National Curriculum subjects are) we note that the Expert Panel suggested other subjects and topics – potentially computer science - could be stated in the form of "short, refined and condensed listings or descriptions of requirements concerning essential knowledge, understanding or skills. Agreement around underlying principles would meet a key demand from our Curriculum Group and campaign members. Drawing on experience in other countries, together with industry, professional bodies and primary, secondary and tertiary educators, DfE should recognise the underlying principles – as one member termed it the "strong bones" of new curricula - to guide our work in this area.

21 - The Framework for the National Curriculum: a report by the Expert Panel for the National Curriculum Review (Department for Education: December 2011): 4.8. With specific reference to Next Gen Skills the Panel notes: "We have also noted the arguments, made by some respondents to the Call for Evidence, that there should be more widespread teaching of computer science in secondary schools. We recommend that this proposition is properly considered." https://www.education.gov.uk/publications/standard/publicationDetail/Page1/DFE-00135-2011 4.18.

3b) How can schools be best supported to engage with the ICT industry and subject associations in curriculum development, in order to develop innovative and creative approaches to ICT teaching, including the teaching of Computer Science?

The following comments and recommendations should be read in conjunction with submissions made by BCS and CAS, NESTA, Next Gen, and with support from companies such as Microsoft and Google, as well as many others, who have been vigorously promoting the importance of Computer Science over the last few years.

There is already a significant amount of work being undertaken to modernise the ICT/Computing/ Computer Science curriculum, most notably by NAACE, e-skills UK and Computing at School/BCS. e-skills UK's Behind the Screen project is working to design a new Computing GCSE in a curriculum that will cover computer science including computation principles, systemic thinking, software development and logic. Moreover, new Computer Science GCSEs are currently being developed by OCR and EdExcel in conjunction with professional bodies.

A key incentive for schools will be knowledge of the importance attached to Computer Science by the DfE

Industry initiatives such as Raspberry Pi aim to provide schools with a relevant, modern, cost-effective platform on which to implement the new Computer Science-oriented curricula. Affordability for students is a primary goal of these initiatives; as has historically been the case with musical instruments, there is a recognition that personal ownership of equipment by students offers both motivation and an opportunity to pursue self-directed learning outside school hours.

Teacher training

The embedding of rigorous new Computer Science curricula in schools is a proposition distinct from other areas of National Curriculum reform, in that resources will have to be identified to build a new teaching infrastructure by training current - and new - teachers. There needs to be recognition that we are introducing a new subject and that unlike other GCSE subjects we will need to train or re-train a new generation of teachers.

Given the gap between the potential removal of Information and Communications Technology Programme of Study in September 2012 and the introduction of the new National Curriculum, we are keen that no momentum is lost with regard to the crucial area of teaching and teaching support. Our Curriculum Group argued that teacher training requires the active recruitment of ICT and Computer Science specialists – right from primary into secondary school. In other countries the 'teacher issue' is seen as both fundamental and extremely problematic, given the status of the subject as a 'new' discipline and the propensity for teachers to be self-taught[22]. We believe the issue of appropriate qualifications and Continuing Professional Development for Information and Communications Technology and Computer Science teachers to be extremely important - the Royal Society has concluded that there is a shortage of teachers who are able to teach beyond basic digital literacy: only 35% of ICT teachers hold a relevant post-A-level qualification in the subject[23].

We are keen to ensure that rigour and consistency are at the heart of the new syllabus.

Next Gen Skills believes it is vital that new Computer Science teachers are also equipped with a strong grounding in Computer Science during their training if they do not have existing qualifications in Computer Science. In his speech to BETT, the Secretary of State supported additional Continuing Professional Development for teachers in Information and Communications Technology and Computer Science to ensure educators receive the best possible Initial Teacher Training and Continuing Professional Development in the use of educational technology. He also pledged to work with the Teacher Development Agency to develop teacher training courses in the coming year so that all teachers get the knowledge and experience they need to use technology confidently.

Providing a step change in school technology has been attempted before. Funded by the National Lottery new Opportunities Fund, a broad ICT training for teachers and school librarians programme was launched in 1999 and lasted until 2003. During this period over 485,000 teachers and school librarians signed up for training with one of a range of approved training providers.[24]

Support for school leaders

Successful implementation depends on proper understanding and support for school leaders. For this we need to signal a clear direction of travel for educators. The Next Gen Skills campaign recommends harnessing the dynamism across sectors in a partnership approach between government, professional bodies, industry, schools and universities, rather than risk leaving development to 'early adopters' and industry goodwill alone. Such a partnership could be manifested in a public 'Route Map' agreement with tangible objectives for partners from September 2012 to September 2014 to create a common understanding around the measures which need to be in place for success.

Suggested elements of a Computer Science Route Map 2012-2020 include:

- Funding support for teacher training, as per Next Gen Skills' letter to the Chancellor 28 February 2012 (appended)
- Set target ambition of Computer Science in schools by 2015 (e.g. \half of schools teaching Computer Science in three years)
- Assessing take-up of Computer Science and teacher training / 'golden hellos' in Computer Science
- Greater assurance on quality or teaching and curricula between primary and secondary schools by championing Computer Science with school heads and leaders
- Assistance with engaging school clusters, local authorities and LEPs in their dialogue with local employers

Ensuring Computer Science Basic Curriculum is a solid foundation

Ensuring consistency and scalability of a new flexible curriculum in Computer Science will be a difficult ask for industry alone: co-ordination and partnership is required to provide comprehensive professional development and classroom resources to every school in England. While a more slimmed down National Curriculum will give schools the freedom to innovate, we are keen to ensure that rigour and consistency are at the heart of the new syllabus. We firmly believe that both industry and educators should speak with one voice if there is no prescription in this area. Abandoning Computing/ICT to schools with no guidance would not meet the long-term objectives of our campaign, nor the Department for Education's aim to have subjects with "sufficient disciplinary coherence."

22 - J. Gal-Ezer, C. Beeri, D.Harel, A. Yehudai, A High School Program in Computer science, (IEEE, 1995).

23 - Royal Society, Shut Down or restart: the way forward for computing in UK schools (January 2012). Chapter 7.

24 - http://www.biglotteryfund.org.uk/prog_ict_school_librarians_wales?regioncode=-uk

In order to meet this challenge we propose the development of a single industry/educator implementation body, the National Centre for Excellence in the Teaching of Computer Science, modelled on the DfE-funded National Centre for Excellence in the Teaching of Mathematics[25] or the Israel National Centre for Computer Science Teachers (below).

Next Gen Skills will assist in the co-ordination of resources between schools, industry, professional bodies and universities via a national Network of Computer Science Teaching Excellence, as proposed by CAS and BCS. Such a body could assist policy makers on benchmarking and improvement along the lines of similar structures in Mathematics, providing initial help and eventually a trusted resource for educationalists and industry alike.

Industry support

Industry should play its role in partnership with government. To that end we propose to coordinate industry initiatives to spread best practice, reduce duplication and meet the strategic aims set out above.

- We also agree that Computer Science goals should be pursued through informal channels: project-based learning, cross-curricular themes, competitions and out-of-school clubs have a major role to play in both Computer Science and ICT.
- OfSTED, industry and professional bodies should work together to ensure that there is an appropriate assessment regime to ensure rigour and improvement.
- Following the transfer of responsibilities to schools and employability targets, there is a key role for industry to play promoting computer science with schools, school clusters and LAs/LEPs to develop better careers advice from an early age.
- Next Gen Skills will seek to engage in the development of borough or city curricula and will submit evidence to the London Inquiry on business engagement with inner city schools in April.

Machshava[26] – Israel National Centre for Computer Science Teachers

The Israeli National Centre for Computer Science Teachers was founded in 2000 by the Israeli Ministry of Education and is considered as the professional home for all Israeli computer science teachers. The centre activities are organized around five major themes:

1. Helping create a professional community of Computer Science teachers;
2. Fostering the professional leadership of Computer Science teachers;
3. Supporting, assisting and consulting academic Computer Science education groups, and Computer Science teacher educators and researchers;
4. Collecting and distributing Computer Science education knowledge and experience;
5. Researching and evaluating Computer Science teachers' needs and the centre's activities.

Examples of "Machshava" activities:

- An annual teacher conference with plenary lectures, parallel sessions, discussions, posters, and an exhibition of CSE materials;
- Courses and meetings on specific issues from the high school CS curriculum, such as recursion or software design;
- Publication of annotated papers on different topics, such as novice difficulties, learning and teaching recursion;
- Publication of learning materials suited for the Israeli curriculum, such as questions and laboratories;
- Publication of a journal for teachers, called "Hebetim" (meaning "Aspects in CSE") twice a year.

25 - https://www.ncetm.org.uk/

26 - The centre's Hebrew name "Machshava" (a Hebrew word with connotations for both computer "Machshev" and thought) implies to our belief that in CSE there should be a strong emphasis on thinking processes http://cse.proj.ac.il/index-en.htm

4) Do you have any other comments you would like to make about the proposals in this consultation document?

To underline our argument on the fundamental public policy interest in advancing Computer Science at school, we append recent data showing the decline in pure Computer Science graduates. Although we caveat that universities have more recently offered alternative courses specialising in practical application (e.g. games design), the figures below are also illustrative of the decline of ICT and Computer Science at a secondary level:

We firmly believe that the present Government has an opportunity to be recognised as an administration which re-laid the foundations of Computer Science in schools and helped transform the futures of the next generation of young creatives, scientists and engineers - putting the UK at the front of global technology.

As a coalition including businesses reliant on a strong digital technology skills base, trade, professional and educational bodies, we urge HM Government to ensure that this opportunity is fully taken by ensuring leadership over these two years and beyond to ensure this ambition becomes a reality.

UK domicile (1) enrolments (2) ,to Science, Technology, Engineering and Mathematics (STEM) first degree and postgraduate courses, UK higher education institutions: Academic years 2002/03 and 2010/11

Level of study	Subject area	2002/03	2010/11	Percentage change 2002/03 to 2010/11
First degree	Medicine and dentistry	30,265	41,030	+35.6
	Subjects allied to medicine	87,485	118,310	+35.2
	Biological sciences	89,500	135,970	+51.9
	Veterinary science	2,785	3,845	+38.2
	Agriculture and related subjects	6,775	7,960	+17.5
	Physical sciences	46,175	62,085	+34.5
	Mathematical sciences	17,745	27,755	+56.4
	Computer Science	**73,030**	**56,025**	**-23.3**
	Engineering and technology	63,950	73,545	+15.0
	Architecture, building and planning	22,870	32,780	+43.3
Total	STEM	440,575	559,305	+26.9
Postgraduate	Medicine and dentistry	10,480	14,760	+40.9
	Subjects allied to medicine	27,695	44,950	+62.3
	Biological sciences	16,965	23,955	+41.2
	Veterinary science	385	770	+101.1
	Agriculture and related subjects	2,020	1,735	-14.2
	Physical sciences	10,620	12,490	+17.6
	Mathematical sciences	2,815	3,045	+8.1
	Computer Science	**12,625**	**8,355**	**-33.8**
	Engineering and technology	15,745	18,155	+15.3
	Architecture, building and planning	8,720	10,665	+22.3
Total	STEM	108,065	138,875	+28.5