Schools, Skills and Technology – a plan for action Adrian Oldknow 14/02/12 aoldknow@yahoo.co.uk

1. Many reports from employers and related organisations (CBI, Engineering UK, CIHE, A|D|S etc) have pointed to severe difficulties faced by employers in recruiting STEM-skilled personnel. Previous reports had focused on STEM graduate shortages, but recent increases in HE fees and expansions in apprenticeship routes mean that there is now a much more direct linkage between school leavers and employment.

2. A STEM strategy for schools has been in place for several years, but schools are not required to engage with it, and the approach has been a very fragmented one, concentrating almost exclusively on achieving higher take-up rates for science and mathematics qualification. There is an existing support network through STEMNet and the STEM Ambassador scheme, and there are pockets of effective practice to be found, such as via the Crest awards and STEM clubs – but there is a lack of overall strategic coordination.

3. A group of school and STEM subject teachers' professional associations has been working to develop a bottom-up, sustainable and coordinated whole school approach to addressing the skills needs identified by employers. The group is the Schools and Subject Associations' Working Group (SSAWG). Its current members are the Association of School and College Leaders (ASCL), the Association for Science Education (ASE), the Computing At School group (CAS), the Design and Technology Association (DATA), the Mathematical Association (MA), the National Society for Education in Art and Design (NSEAD) and Primary & Secondary Engineer. The strategy is called **SySTEMiC** and connects **S**chools, **STEM** subjects and **C**areers.

4. The SySTEMiC strategy is based upon groups of students engaging in inter-disciplinary projects, research and problem-solving activities supported by their teachers. These activities will be carefully designed to engage the interest of students and they will involve them in developing the personal, team, learning, entrepreneurial and communication skills sought by employers. They will motivate students to learn more about the role of technology in our society (past, present and future) and more about the contribution which mathematics, science, engineering and computing makes to it. The strategy is designed both to reflect the skills needs of employers and to ensure that teaching and learning in STEM-related subjects is more relevant, exciting, challenging and rewarding than is currently the case. It builds upon the best of existing practice supplemented by innovative approaches to technological education where needed.

5. The current educational scene in English schools is in quite a volatile state. There is an ongoing curriculum review. The White Paper gives greater freedom for schools to determine their own priorities and the composition of the range of experiences and courses which together constitute its curriculum. The Chairman of Google, Dr. Eric Schmidt, made public, wide-scale criticisms of the state of UK technological education in his speech at the Edinburgh Festival last August – which have not been refuted by the current government. NESTA's `Next Gen' report on the skills needs for the video games industry has attracted a government response, and there is now a `Next Gen Skills Campaign'. There is a current debate on the future of the existing ICT curriculum for schools, and the possible future role of computer programming and computer science. Considerable concern has been expressed, such as from the engineering employers, about the recent downgrading of some of the vocational qualifications for schools, such as the Diploma.

6. The acronyms STEM (UK/USA) and MST (EU) are coarse descriptors for the set of technical and associated skills needed by employers. They have induced an educational mind-set in which it is viewed as both necessary and sufficient to concentrate solely on separate school subjects, particularly mathematics and science. A far more radical rethink is needed for schools to make an adequate response to the skills crisis.

7. While very many nations, including USA, the EU, Scotland, Wales and Northern Ireland, have made STEM (or MST) a major focus of education in schools - this is still not the case in England. The current government's "Plan for Growth" involves plans of action for most of the major ministries, with the notable exception of the Department for Education (DfE). DfE officials involved with the Curriculum Review have now responded very positively to the SySTEMiC strategy. In recent speeches, the Secretary of State for

Education, Michael Gove, has declared that changes are on the way concerning the place of technology in schools. (See: http://www.agent4change.net/ict-policy/government-strategy/1256-uks-xmas-treat-a-regeneration-of-stem-innovation.html)

8. In its SySTEMiC strategy, SSAWG is advocating a whole-school, activity-based approach to teaching and learning about technology in Key Stage 2 (9-11) and Key Stage 3 (11-13) which could impact on all school subjects. While such an approach would involve a radical change to the way most schools currently organise their timetables, it need not be particularly disruptive to the school routine – effectively bringing a couple of hours of club-like activity within the normal working week. Not only would it provide Enhancement and Enrichment for learners within the school curriculum, it would also provide unthreatening ways for teachers to develop their own skills, knowledge and understanding as collaborative learners with their students. There are already models of accreditation both for learners and teachers engaging in this kind of activity, such as through the British Science Association and the Engineering Development Trust (EDT). At the end of Key Stage 3 it is vital that schools make effective use of employer engagement to provide up-to-date career advice to students as they make informed choices about the courses of study to follow post-14.

9. SSAWG envisages that both at Key Stage 4 (14-16) and post-16 students will follow courses of study broadly similar to those on offer currently. However it is vital that the spirit of the pervasiveness and importance of technology is not lost, and that the teaching of STEM-related subjects does prepare students with the kinds of skills practised by subject professionals in the field – especially in the use of appropriate digital technologies. Continued employer engagement and career advice is an essential element of the broader curriculum. Teachers' STEM-subject professional associations need to have an ongoing involvement in supporting teachers through continued professional development, and in the development of appropriate teaching materials and advice in collaboration with employers, organisations, HE and publishers.

10. Technical skills shortages, especially in engineering, are not new – and the UK has always had a leading edge in developing innovative approaches to the school curriculum. As a result there is already a wealth of existing educational resources, especially in the sciences and mathematics, which are not in current use but which could easily be repurposed to meet many of the current needs. Many of these resources have been acquired by the National STEM Centre in York and are now available digitally.

11. Outside school education there are also many interesting developments with far-reaching potential. These include the development of the very low-cost Raspberry Pi single board computers (£16 and £26), the availability of a wide range of free open-source software, including programming languages, and a proposed new BBC TV series for home users. We should have the means to recreate the kind of family interest in computing devices which was generated 30 years ago at the time of the BBC micro and BBC TV's `The Computer Programme' - alongside the educational strategy of the Microelectronics Education Programme.

12. We hope that those major companies and organisations with a commitment to improving education and with influence on government will join with us in a concerted programme of action on three fronts.

13. Action 1: **Leadership** - applying political pressure on government minsters to take a positive lead in issuing a call-to-arms to schools to make a significant contribution to meeting the skills needs of employers – and to engage DfE, DBIS, DCMS and others in working together with employers, schools and teachers.

14. Action 2: **Coordination** - engaging with schools and teachers in developing a coordinated and sustainable approach to technological education for schools in England.

15. Action 3: **Implementation** – supporting our development of a Centre for Innovation in Technological Education in Cambridge (CCITE) within which the best ideas can be shaped into blueprints for action which can be trialled, evaluated and refined in schools, colleges and academies within one region and disseminated widely for putting into practice throughout pre-19 education in the UK.