



## Education for innovation

Innovative individuals derive confidence from their mastery of the basic skills that are the building blocks of all good education, and possess the deep subject knowledge that allows them to create new ideas. They seize the initiative, challenge accepted norms and have the soft skills they need to develop and exploit these ideas. The UK should maintain its focus on developing both basic and advanced technical skills. However, simultaneously, it needs to boost the number of people who have the soft skills and attitudes essential to innovation.

These skills and attitudes are best developed in young people where both formal and informal influences play a significant role. A series of existing initiatives centred on creativity, enterprise and school leadership provide many of the building blocks necessary for delivering education for innovation. Some schools have pieced these together to generate a climate that teaches skills while encouraging risk-taking, collaboration and innovation. However, across the UK, these do not yet add up to a coherent strategy.

In the short term, the role that existing school-focused programmes play in innovation, and how these link in with initiatives beyond the school gate, should be reviewed. More should be done to facilitate learning between schools on how the best among them encourage and enable innovative behaviour. In the longer-term, soft skills for innovation need to be embedded across the curriculum and into the culture of schools.

### Innovative individuals benefit the UK's economy and society

#### Innovation is essential to the UK's economic and social development

Innovation is increasingly important to mature economies such as the UK. Accordingly, the Department of Trade and Industry has recognised that innovation 'is key to improving the country's future wealth creation prospects.'<sup>1</sup> Further, HM Treasury has identified innovation as one of its five drivers of productivity.<sup>2</sup>

However, the long-term welfare of the UK population reaches far beyond narrow measures of productivity, extending into the development and implementation of social innovations and new models of public service delivery.<sup>3</sup> Indeed, the scale of challenges such as environmental sustainability and an aging population will require individuals to become involved in innovation to a greater degree than ever before – even to the level of 'co-creation'.<sup>4</sup>

#### There is no innovation without innovators

Innovation is now widely recognised to normally be an iterative, interdisciplinary and collaborative process rather than the work of a lone 'heroic inventor'.<sup>5</sup> However, innovative teams, organisations and localities are made up of individuals, all of whom play different roles in developing innovations. As such, individual skills and attitudes are essential for creating, developing, diffusing and adopting an innovation.<sup>6</sup>

#### Innovative individuals have hard skills, soft skills and attitudes conducive to innovation

If individuals are to participate successfully in innovation, they generally require a combination of hard and soft skills.<sup>7</sup> On top of the basic skills essential to all education, most obvious are hard skills that tend to be technical and highly subject-specific. While these

1. DTI (2004), 'Science and innovation investment framework 2004-2014', DTI, London.
2. HM Treasury (2000), 'Productivity in the UK: The Evidence and the Government's Approach', HM Treasury, London.
3. For background on social innovation see NESTA (2007), 'Innovation in response to social challenges', NESTA, London; and The Young Foundation (2006), 'Social Silicon Valleys', The Young Foundation, London. For background on innovation in the public sector, see Mulgan G. (2007), 'Ready or not? Taking innovation in the public sector seriously', NESTA, London.
4. Cottam H. and Leadbeater C. (2004), 'Health: co-creating services', Design Council, London.
5. For background on the changing understanding of innovation see NESTA (2006), 'The Innovation Gap: Why policy needs to reflect the reality of innovation in the UK', NESTA, London.
6. For background on the diffusion of innovation see Rogers, E. M. (2003), 'Diffusion of Innovation', Fifth Edition, Free Press, New York.
7. Csikszentmihalyi, M. (1996), 'Creativity: Flow and the psychology of discovery and invention', Harper Collins Publishers, New York. Csikszentmihalyi acknowledges that creative individuals must both 'learn the rules and content of the domain' (p47) as well as 'have an ability to adapt to almost any situation and to make do with whatever is at hand' (p53).

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8. Bloom, B. S. (1956) 'Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain', David McKay Co Inc., New York.

9. Colangelo et al (2003), 'Young Inventors' (Chapter) in 'The International Handbook on Innovation', Elsevier Science, UK.

10. Ofsted (2005), 'Developing enterprising young people: features of the successful implementation of enterprise education at Key Stage 4', Ofsted, London. This report states that inspection evidence shows that 'students are motivated by effective enterprise education and that it can also result in better teaching and learning across the curriculum.'

11. Handy, C. (2001), 'The Elephant and the Flea: Looking Backwards to the Future', Hutchinson, Random House, London. Charles Handy argues that while portfolio careers may not be a choice of individuals, they may end up pursuing them without realising.

12. Leitch S. (2006), 'Leitch Review of Skills: Prosperity for all in the global economy – world class skills', HM Treasury, London.

13. Leitch S. (2006), 'Leitch Review of Skills: Prosperity for all in the global economy – world class skills', HM Treasury, London.

14. Learning and Skills Council (2006), 'National Employers Skills Survey 2005', LSC, London.

15. Gillinson, S. and O'Leary, D. (2006), 'How to reconnect young people and organisations' based on GfK NOP polling carried out for DEMOS. When asked 'Which do you believe will be the most important skill, quality or aptitude for potential graduate employees to have in ten years' time?', 24 per cent answered 'creativity and innovation'.

16. Green, H. and O'Leary, D. (2007), 'Ready for the future? Young people's views on work and careers', NESTA, London.

17. Visser & Krosnick, (1998), 'Development of Attitude Strength Over the Life Cycle: Surge and Decline', Journal of Personality and Social Psychology, 1998, Vol. 75, No. 6, p1389-1410. The authors also show that attitudes are easier to change at a late age due to weakening social networks that usually reinforce one's own attitudes.

include science, engineering and technology (SET) skills, they also include any subject that contributes directly to a person's ability to carry out a job – for example, advanced writing for media and journalism, or technical artistic skills for fine art.

By contrast, soft, cognitive skills are not subject-specific. Instead, they refer to cross-disciplinary skills such as adaptability, creativity, problem-solving, collaboration, interpersonal skills and leadership – the skills that are the building blocks of thinking and learning.<sup>8</sup>

While innovators are highly diverse, they are often characterised by specific attitudes, including their willingness to take risk, readiness to challenge established practices, quickness to seize initiatives, and keenness to confront problems.<sup>9</sup>

### **Skills for innovation are useful for life and education**

Apart from increasing people's ability to innovate, the development of soft skills improves the learning of other skills.<sup>10</sup>

Moreover, generic skills such as problem-solving, creativity and leadership, combined with an ability to appraise risk and take the initiative, help individuals succeed in life and work, particularly in a 21st century economy increasingly dominated by portfolio careers, multi-jobbing, uncertainty and longer working lives.<sup>11</sup>

### **The UK needs to increase its supply of innovative individuals**

#### **The number of people with hard skills is increasing**

Between 1994 and 2004, the proportion of people in employment with no qualifications fell from 18 per cent to 11 per cent, and the proportion with a Level 4 qualification or above increased from one fifth to nearly one quarter.<sup>12</sup> Driving up innovation is dependent on further increases in the number of people with hard skills, and as such, the UK is right to continue to prioritise this as a policy goal. In 2004, HM Treasury commissioned the Leitch Review of Skills, which looked at the UK's long-term skills needs, and is now looking to implement many of its recommendations.<sup>13</sup>

### **But the UK needs more people with the soft skills and attitudes essential to innovation**

Partly as a result of the success in driving up the number of people with qualifications, and partly due to an increasing need to institutionalise innovation, employers are now reporting greater shortages in problem solving, communication skills and teamworking than literacy and numeracy.<sup>14</sup> Indeed, when asked, businesses named 'creativity and innovation' as the most important skill, quality or aptitude that graduates should have in ten years time.<sup>15</sup>

#### **Young people do not recognise the importance of these soft skills**

Whereas employers are reporting skills shortages in soft skill areas, young people tend to see education as largely providing hard skills and qualifications, and 79 per cent see qualifications as one of three most important factors in getting a job. Meanwhile, having good ideas is seen as important by just 12 per cent.<sup>16</sup>

### **Developing the skills for innovation is best done at a young age and involves a range of influences**

#### **Innovative skills and attitudes are best-formed at a young age**

Developing many of the skills and attitudes necessary for innovation is best done during childhood and youth.<sup>17</sup> This is particularly the case for attitudes and soft skills. While technical learning can be influenced with a variable degree of effectiveness throughout life, attitudes often become resistant to change and more persistent over time.<sup>18</sup> Cognitive learning is slower, more subtle and easier to influence at a young age, which is characterised by deep learning.<sup>19</sup>

#### **Both formal and informal education help the development of skills for innovation**

Both formal and informal education play an important role in the development of young people – 37 per cent say that they learn the most from school, while 39 per cent believe that parents are most important.<sup>20</sup> Other areas of informal learning such as the Duke of Edinburgh Awards, Scouts, Guides, other community groups and volunteering, present young people with additional opportunities to develop skills and attitudes conducive to innovation. The Internet is increasingly allowing young people to engage in self-directed learning, with 15 per cent citing the web as their most important source of knowledge.<sup>21</sup>

## Governments have provided several of the components for education for innovation

Education policy in the UK is devolved. As such, England, Scotland, Wales and Northern Ireland have each undertaken their own reviews and programmes, which have focused on components of education for innovation.

### England has reviewed the teaching of creativity and enterprise

Over the last six years, a number of government reports and reviews have been published focusing on components of innovation-related skills and attitudes. These include the Paul Roberts' report on nurturing creativity,<sup>22</sup> the Gilbert Review on personalised learning<sup>23</sup> and the Davies Review of enterprise in education.<sup>24</sup> The Qualifications and Curriculum Authority (QCA) are currently undertaking a review looking at how to increase flexibility in teaching the secondary curriculum to allow greater personalisation in learning.<sup>25</sup>

A number of specific programmes have subsequently been launched focused around enterprise education. These include a commitment to five days of enterprise education for every Key Stage Four (14-16) pupil, and (at the university level) the establishment of the National Council for Graduate Entrepreneurship to raise the profile of entrepreneurship amongst students and graduates. Established in 2004, Enterprise Week has involved over one million young people from across the UK attending events intended to inspire them about enterprise.<sup>26</sup>

### DfES initiatives have allowed innovations in the way English schools are structured

Many schools are beginning to embrace the concept of 'extended schools', and are deepening community links and functioning as hubs for extra-curricular activities.<sup>27</sup> This extends the opportunities for their pupils to play sport, engage in arts and drama, volunteer and make creative use of ICT. Academies draw on the skills of sponsors and other supporters to drive change in school leadership.<sup>28</sup> The Specialist Schools Programme helps schools, also in partnership with private sector sponsors, to establish distinctive identities through chosen specialisms.<sup>29</sup>

Initiatives such as these could potentially improve education for innovation – whether through improving opportunities for the development of soft skills, linking academic subjects to real-world problems, allowing schools to develop deep technical specialisms or allowing greater freedom in how to teach the curriculum.

### Devolved administrations have particularly focused on enterprise education

The Youth Enterprise and Entrepreneurship Strategy for Wales set out the Welsh Assembly Government's response to reports documenting an increasing need for entrepreneurial and enterprising skills.<sup>30</sup> In Scotland, the Determined to Succeed programme was launched in 2003 by the Scottish Executive to support enterprise in education programmes.<sup>31</sup> This has led to the development of nearly 8,000 school/business partnerships, 22,000 teachers being trained in enterprise education, and all schools participating in some form of enterprise education.<sup>32</sup> The Curriculum for Excellence in Scotland has also been developed to look at flexibility in the Scottish curriculum and to make changes to it to try to equip young people with the skills they need for future employment.<sup>33</sup> While these changes in both Scotland and Wales are steps in the right direction, it is too early to judge how effective they have been.

In Northern Ireland, a revised school curriculum, incorporating cross-curricular skills such as creativity and communication, is being introduced to bring about greater flexibility and an increased emphasis on personal development.<sup>34</sup> This focus on cross-curricular themes may stimulate innovation by 'allowing different sorts of knowledge, disciplines and expertise to collide [producing] the spark of a new idea and what's needed to turn it into an innovation.'<sup>35</sup>

### These address components of the skillset required for innovation

Existing initiatives across the UK go some way to developing an education system that provides young people with the skills and attitudes necessary for innovation. Enterprise education teaches important hard and soft skills; creativity education will potentially improve the creation of new ideas; extended schools provide for strong linkages with the wider community that influences the development of young people; and changes in school governance may create more space for these initiatives to be implemented.

18. Krosnick, J. A., & Petty, R. E. (1995). 'Attitude strength: An overview' in Petty, R.E. & Krosnick, J. A. (Eds.), 'Attitude strength: Antecedents and consequences', p.1-24, Hillsdale, NJ: Erlbaum.

19. Boninger, D. S., Krosnick, J. A., & Berent, M. K. (1995). 'The causes of attitude importance: Self-interest, social identification, and values', *Journal of Personality and Social Psychology*, 68, 61-80.

20. Green, H. and O'Leary, D. (2007), 'Ready for the future? Young people's views on work and careers', NESTA, London.

21. Green, H. and O'Leary, D. (2007), 'Ready for the future? Young people's views on work and careers', NESTA, London.

22. Roberts, P. (2006), 'Nurturing Creativity in Young People, A report to Government to inform future policy', Department for Culture, Media and Sport, London.

23. Teaching and Learning in 2020 Review Group (2006), '2020 Vision - Report of the Teaching and Learning in 2020 Review Group', Department for Education and Skills, London.

24. Davies, H. (2002), 'A Review of Enterprise and the Economy in Education', Department for Education and Skills, London.

25. For further background see <http://www.qca.org.uk/secondarycurriculumreview/>

26. For further background see <http://ncge.com/> and <http://www.startalkingideas.org/>

27. For further background see <http://www.teachernet.gov.uk/wholeschool/extendedschools/>

28. For further background see [http://www.standards.dfes.gov.uk/academies/what\\_are\\_academies/?version=1](http://www.standards.dfes.gov.uk/academies/what_are_academies/?version=1)

29. For further background see [http://www.standards.dfes.gov.uk/specialistschools/what\\_are/?version=1](http://www.standards.dfes.gov.uk/specialistschools/what_are/?version=1)

30. WDA (2004), 'a Youth Enterprise and Entrepreneurship Strategy for Wales', Welsh Assembly Government.

31. For further background see <http://www.determinedtosucceed.co.uk>

32. Smarter Scotland Scottish Executive (2007), 'Determined to Succeed, Three Years On...', Scottish Executive, Glasgow.

33. For further background see <http://www.acurriculumforexcellencescotland.gov.uk/>

34. For further background see <http://www.pmbni.org.uk/curriculum/index.asp>

35. Hargreaves, D. H. (2000). 'Towards Education for Innovation', presentation at the Institute of Education, London, 22 November 2000.

## **But a more integrated approach to education for innovation is required**

### **Enable peer-to-peer learning between schools**

Through leadership at all levels, some schools have managed to piece together these existing initiatives to generate a school ethos that encourages students to take risks and collaborate.<sup>36</sup>

However, as the Gilbert Review pointed out, in the education system 'no single organisation is responsible for capturing knowledge and experience.'<sup>37</sup> More should therefore be done to facilitate peer-to-peer learning between schools and to encourage them to develop an ethos conducive to education for innovation.

Organisations like the DfES funded Innovation Unit<sup>38</sup> and the Specialist Schools and Academies Trust<sup>39</sup> may have a stronger role to play, but as the Gilbert Review recommends 'schools should identify areas of knowledge and successful practice that could be shared either within the school or with other schools, and make it a priority to find ways of doing so.'<sup>40</sup>

### **Consider how existing initiatives fit into a wider drive for education for innovation**

Current initiatives are not conceptualised as parts of a comprehensive strategy to educate for innovation. These initiatives should be reviewed and thought through as part of a framework that covers the entire package of skills and attitudes required by the UK's next generation of innovators. This must consider the full range of influences on the skills and attitudes of young people, including the role of informal educators and the links between these and the formal education system.

### **Embed soft skills across the school curriculum**

In order to drive up levels of innovation, the current policy focus on the development of basic skills and advanced technical skills must continue. This needs to be supplemented by a better understanding of the importance of soft skills and by a long-term strategy to embed them across the curriculum from 5-19 years. Given the importance of such skills in helping individuals to learn hard, technical skills, this objective will support the achievement of existing educational aims.

## **This is likely to involve subtle changes to assessment and the professional development of teachers**

As our understanding of the best ways to develop the skills and attitudes required for innovation improves, modifications are likely to be needed to three key drivers of the education system: assessment, inspection and the professional development of teachers. In particular, if standards are to be maintained and improved, some intelligent method of assessing the development of skills and attitudes for innovation will be necessary, as will adaptations to the demands on teachers and school administration.

## **NESTA is launching Future Innovators to develop education for innovation**

NESTA's Future Innovators programme demonstrates how to help young people gain the skills and attitudes needed for innovation, navigate the future economy and create opportunities from it.

It works across the UK, in partnership with schools, educational bodies and those who work with young people. These partners bring expertise, networks and contacts and are willing to take considered risks to experiment with new approaches.

The findings from this work will be disseminated widely in order to demonstrate how the competencies for innovation could be embedded into the curriculum, and how the culture of the education system can be changed to better support innovation.

For more information see <http://www.nesta.org.uk/futureinnovators>

36. Taylor, C.J.H. and Ryan, C. (2005), 'Excellence in education, the making of great schools' Granada Learning, London.

37. Teaching and Learning in 2020 Review Group (2006), '2020 Vision - Report of the Teaching and Learning in 2020 Review Group', Department for Education and Skills, London.

38. The DfES-funded Innovation Unit may have a stronger role to play in achieving this. It promotes innovation to improve education. For further background see <http://www.innovation-unit.co.uk>

39. For further background see <http://www.specialistschoolstrust.org.uk/>

40. Teaching and Learning in 2020 Review Group (2006), '2020 Vision - Report of the Teaching and Learning in 2020 Review Group', Department for Education and Skills, London. Schools have made some progress in this regard, through, for example, the networks established by the SSAT.