

The Creative Industries Federation's

Creative Education Agenda

How and why the next government
should support cultural and creative
learning in the UK



Science and arts are not an either/or.

Nobel laureates in the sciences are seventeen times more likely than the average scientist to be a painter, twelve times as likely to be a poet, and four times as likely to be a musician.¹ And yet only 8.4% of English students combine arts and STEM subjects at A-Level.²

Of course, not everyone can be a nobel laureate...but a comprehensive education encouraging creative thinking and skills should be top of our government's agenda.

A narrow focus on science, technology and maths will not deliver the innovation and creative thinking we need. Arts, including crafts and design, are a vital part of the mix. Let's break down these artificial barriers and place arts with science, technology and maths, at the heart of the education system.

Let's turn STEM into STEAM.

Where would science, technology, engineering and mathematics be without the creative arts and humanities in particular? In a dire place. I think one of the greatest problems for UK research is how ideas leave the laboratory bench and benefit society, especially how it is- or more often, is not- taken up by industry. This is because we train STEM people to think inside their singular silos and to be creative there, but not in how to relate to people outside their increasingly narrow disciplinary straitjackets.

*Professor Nick Tyler, CBE FREng FRSA FICE,
Chadwick Professor of Civil Engineering, UCL*

The Call to Action

- 1 England is the only nation in the United Kingdom not to have a national plan that ensures that all children and young people are offered a high quality cultural and creative education. England must join Wales, Scotland and Northern Ireland in producing their own complementary national plan. For social and economic reasons it is essential for the future strength and growth of the UK that all children and young people have access to culturally expressive lives and the creative skills required for successful careers in the creative economy. This means ensuring that all children have the opportunity to have a STEAM (science, technology, engineering, arts ³, mathematics) education that also develops creativity, technology and enterprise across the curriculum and through extracurricular activities.
- 2 Ofsted should not judge a school to be 'outstanding' without evidence of a quality cultural and creative offer in the curriculum, supported by extracurricular activities. Every child should have the same entitlement to a STEAM education that is offered by our leading independent schools.
- 3 A creative subject ⁴ must be part of the EBacc.
- 4 Universities, in particular those in the Russell Group, should review their selection criteria in order to positively encourage a mixed portfolio of qualifications at Key Stages 4 and 5 (GCSE and AS/A-Level). Universities piloting courses with STEAM acceptance criteria (e.g. UCL's Civil Engineering course, led by Professor Nick Tyler) should have their results publicised and disseminated, alongside the existing evidence that young women who previously studied only arts and humanities are likely to

pursue a STEM career if encouraged to combine STEM with arts at school.⁵

- 5 We support the work of the Gatsby Foundation in recommending that every secondary school should be required to have a Careers Plan, published on the school's website. Every secondary school should be responsible for publishing the destinations of all pupils for three years after their leaving date. The published destination data should be at an aggregated level, showing the main categories of employment, apprenticeship and further and higher education.⁶ We look forward to working with them to pilot their recommendations later this year and to use this initiative to develop awareness of the broad spectrum of careers in the creative industries and creative economy.
- 6 In agreement with the work of the Warwick Commission, we believe there should be a national creative apprenticeship scheme supported by more robust and detailed data on pipeline supply of creative and technical talent. This scheme would rationalise and scale up existing initiatives by BIS, ACE and sector skills councils.⁷

On a team we always need people with different skills. My strength as an engineer was not maths. But I had an ability to see things in 3D - the whole picture was in my head. And in a team I was as valuable as the ones who were great at maths or programming computers, or who understood the chemistry of gases. And I had the collaborative instincts to be able to create a variety of different teams with many different strengths in order to get the job done.

*Dr Andy Charalambous, HEP Artist in Residence,
Astronomy Artist in Residence & Honorary Research
Fellow, Physics & Astronomy, UCL*

Science and creative education go hand-in-hand. Engagement with materials develops new ways of thinking, and the practical intelligence and ingenuity vital for our future prosperity. Increasingly, makers are stimulating innovation in medicine, engineering and technology by applying deep knowledge of materials and processes to new fields. That is why, alongside the launch of our innovation programme, the Crafts Council published “Our Future is in the Making”, an education manifesto that champions the importance of craft education for the scientists and makers of the future.

Rosy Greenlees, Executive Director, Crafts Council

The Problem

One of the UK's unique selling points is the creativity and diversity of its population. We have produced creative designers, engineers, scientists and technologists who have shaped the world we live in and contributed to our prosperity and quality of life. We are internationally recognised for our arts and culture. Creativity drives our enterprise and ambition as well as our economy. Our success in the future will depend on our willingness to act now in order to ensure that creativity and enterprise is the foundation of our education system. We join organisations like the Cultural Learning Alliance and Nesta in encouraging the next generation to combine the creative skills offered in the arts, science and technology in order to remain world leaders in innovation and invention. Alongside this, we argue that there is an urgent need to provide careers advice and vocational pathways for technical careers in the creative industries and creative careers in the STEM sector.

- The UK already has a high percentage of creative employment,⁸ constituting around 24% of the workforce, with 87% of highly creative occupations at low risk of being replaced by robots in the future.⁹
- The creative economy¹⁰ accounts for over 2.5 million jobs. Predicted growth in the creative economy will rise from 10% in 2014 to 20% in 2020.¹¹
- The creative industries¹² contributes over £77 billion a year to the UK's economy and £15.5 billion of exports.¹³ Taking a sample of 200 Civil Engineering (QUEST) scholarship applicants in 2014, 36.5% studied a creative

or design subject to AS/A-Level, with 67% combining arts and STEM at GCSE.¹⁴ This suggests that our most gifted engineering students have successfully combined STEM with the arts.

- Almost 25% of those employed in the visual effects industry have a degree in a STEM subject (including maths, physics, engineering and computer science).¹⁵
- AND YET from 2012–13 only 8.4% of students combined arts and science disciplines at AS level.¹⁶
- Only 5% of those accepted for Maths and Computer Science courses have studied A Level Art and Design.¹⁷
- There was a 50% drop in the number of students taking GCSE Design and Technology between 2003–2013.¹⁸
- There has been a 25% drop in other craft related GCSEs from 2007–2013.¹⁹
- Failure to meet engineering skills demand will cost the UK £27 billion a year.²⁰
- And for 89% of the Federation’s members, education and ensuring a pipeline of talent for the creative industries is the greatest policy concern.

Our current education system, particularly in England, has created a gulf between STEM and arts subjects with the assumption that the arts are creative but not useful in an economic sense. The STEM subjects, on the other hand, are seen as non-creative drivers of the economy. These are

dangerous misconceptions. We need creative scientists and engineers as well as artists and designers who understand the affordances of materials and the uses of technology. From the age of 13 students are encouraged to follow the sciences or arts rather than a combination of both. None of our international competitors impose these stark choices on their young. By the time students reach AS-Levels, or go on to apprenticeships, this may be the right choice for some, but not for all.

Research by Nesta has shown that whilst some creative jobs are susceptible to automation, people with creative skills are the beneficiaries of the digital age, as digital technologies are making creative skills even more productive.²¹ We need to continue to build this workforce by providing all of those in our education system with ample opportunity to express and explore their creativity in a variety of different ways, both in and out of the curriculum. We also must ensure that these students have the best advice when it comes to choosing subjects that will help them to not only move on to higher education or into apprenticeships, but to build their careers as well.

The Federation’s commitment to STEAM also recognises the urgent need to infuse the whole curriculum with creativity, enterprise and technology. The UK’s leading edge in the creative industries and STEM will depend on a supply of graduates and apprentices who are imaginative, ambitious and make innovative use of new technologies.

Worryingly, research shows that the arts are increasingly becoming a privilege rather than an entitlement in our schools, only available to those who can afford them. And although the arts are not the only vehicle for ‘creativity’, they offer particular ways of encouraging creative thinking in children and young

people which are relevant to every profession, in particular those in STEM industries and the creative industries.

Just like the study of mathematics, these are skills that are essential for every young person to have, part of a toolbox that should be given to all.

In the UK, not only is GCSE and A-Level take-up dropping, but the number of primary school children taking part in after-school arts classes has fallen by a third since 2010.²² In addition, figures show that only one in three primary school children now take part in music activities – compared to just over half in 2010. Similarly, the proportion of children doing drama and dance classes has fallen from 49% and 45% respectively to just 33% for both.²³

- With the introduction of the EBacc, schools with a high proportion of children on free school meals have been more than twice as likely to withdraw arts subjects than schools with a low proportion (21% versus 8%).²⁴
- 22% of parents in the higher social groups pay £500 plus a year on extracurricular arts activities compared to 10% of parents in middle and lower groups.²⁵
- Research by IPSOS Mori shows that 70% of children whose parents have no graduate qualifications spend less than three hours a week on cultural activity compared to 80% of children with graduate parents who spend more than three hours a week.²⁶

In this paper we have argued for a STEAM education to ensure the continuing growth of our economy and creative workforce.

I'm a videogames designer and programmer, and so engineering and the arts are completely inseparable in my work. The creativity fostered by the arts is absolutely crucial in creating games. After all, the strength of computer games lies not only as an entertainment medium generating over £2bn in sales for UK developers, but also crucially as an important cultural form for the 21st century. Therefore, as a STEM Ambassador, I cannot stress enough the importance of an arts education in addition to technology and coding.

*Mitu Khandaker, Games entrepreneur and founder,
The Tiniest Shark*

What kinds of work are we preparing young people for? Are we preparing them to work in a creative economy, or are we preparing them to work in service and the parts of manufacturing that are likely to become fully automated by the time they enter the job market?

Jonathan Neelands, National Teaching Fellow, Professor of Creative Education, WBS and Creative Industries Federation, Research Project Director

True scientific progress relies as much on an excellent specific education as on creativity and an ability to think and venture beyond what appears to be correct and reasonable.

Philipp Kukura, Associate Professor of Physical Chemistry, University of Oxford

But a STEAM education would also guarantee that all our children, regardless of who they might become, have access to a rich and culturally expressive life.

Educators, employers, the government and the media have a responsibility to inspire students to combine arts, design, music and craft with sciences, technology, engineering and maths. The future success of the UK depends on a workforce with creative and STEM skills. We need to provide all young people with the skills for a sustainable and diverse career, and for many students this will mean a combination of STEM with arts, design, music, creative writing or craft.

The Evidence

Art and Design have been shown to encourage geometrical understanding and general observational skills.²⁷ Drawing or painting develops the craft skills which are relevant to those experimenting in anything from molecular biophysics or software development to architecture or blog writing. At school level, visual arts provides an unparalleled opportunity to create and experiment.

Music has been shown to boost academic performance and phonological skills²⁸, and data from the Civil Engineering (QUEST) scholarship applicants shows that 35% studied a musical instrument in their spare time upon application. This is yet another indication that the study of music encourages and develops skills that are of interest to STEM employers in and of themselves. At GCSE and A-Level, composition can offer students the opportunity to use technology to be creative - a combination of precision, technological ability and creativity that should be invaluable to future employers.

Drama not only strengthens verbal skills useful in schools, but theatre education has been shown to improve writing, oral understanding, understanding of writing, reading and language. Being able to communicate is not only the preserve of those who will go on to stand on a stage, but an essential skill for those in any career. In particular these oral skills benefit the socioeconomically disadvantaged, which is why it is concerning that from 2003–2013 there was a 23% drop in students taking drama GCSE.²⁹

Around 20% of students on civil engineering degree programmes have gained a design qualification at AS or A level. An interest in design is a key factor in students' choices to pursue engineering and British students, many of whom have a creative element in their education, are, perhaps as a result, noticeably more flexible in their thinking, inventive and particularly good at problem solving....all really good qualities to have in any business and certainly in engineering.

*Andrew Stanley, Head of Education Policy,
Institution of Civil Engineers*

Alongside the former Education Secretary Kenneth Baker, I'm supporting the establishment of "University Technical Colleges": all-ability academies for 14-18 year-olds with a specialist focus on technical areas with strong employment potential, including engineering, construction, digital media and the creative arts. Arts education is a vital part of the mix in all schools - we need STEAM, not STEM alone.

*Lord Adonis, reformer, writer,
Labour Peer + Trustee of Teach First*

Design and Technology. The work of the Design & Technology Association has demonstrated that "until 2013 D&T was always the most popular optional GCSE subject, but over the last 10 years there has been a decrease in the entry from just under 450,000 a year to just under 250,000. This is now less than a third of the annual cohort. In addition, DfE figures released in 2014 show that since 2010 the number of hours the arts and technical subjects are taught and the number of associated teachers in schools have fallen. Design and Technology is experiencing the greatest decline with 11% fewer teachers and hours of teaching"³⁰. According to Sir James Dyson it is "the only subject that puts science and maths into a practical format, giving young people an opportunity to understand how a product works and invent in a better way".³¹

An extensive body of correlational data in the United States has shown that students who participate in multiple arts courses have higher educational attainment levels (as measured by grades in school and scores on verbal and mathematical standardised tests) than those who take fewer or no arts courses. One study showed that this relationship exists for students at both the high and low ends of the socioeconomic spectrum.³² In the UK the Cultural Learning Alliance has used large scale cohort studies³³ to demonstrate that:

- Learning through arts and culture improves attainment in all subjects.
- Participation in structured arts activities increases cognitive abilities.

Northern Ireland's successful screen industries have been driven by talented, innovative people with a diverse range of skills – the industry will always be led by technological innovation in combination with creativity, superb craft skills and great storytelling. It is this combination of the arts with the sciences and technology that creates the foundations for successful innovation and dynamic businesses. By putting the 'A' into STEM, to give us STEAM, we add some really magical ingredients that lift our creative industries to new levels

*Bernard McCloskey, Head of Education,
Northern Ireland Screen*

- Students from low income families who take part in arts activities at school are three times more likely to get a degree.
- Employability of students who study arts subjects is higher and they are more likely to stay in employment.
- Students who engage in the arts at school are twice as likely to volunteer and 20% more likely to vote as adults.

By encouraging a STEAM curriculum, not only do we widen the talent field for creative industries and STEM through the socioeconomic groups, but we may also begin to address some of the gender disparities. Research done by the Institution of Mechanical Engineers looked at 'tribes' of school students who might be interested in becoming engineers. The second largest group, predominantly female (55%), were Social Artists - a creative section of the population who seemingly have little affinity with STEM, and were unlikely to pursue STEM professions. They were, however, confident in STEM subjects, and the researchers concluded that the group comprises many potential engineers who "would be more inclined to contemplate what is on offer if the engineering community were better able to promote its creative side". In particular it was noted that these students "displayed little connection with technologies presented, with the exception of engineering related to art and design".³⁴

We need to recruit 2 million new scientists, engineers, technicians and mathematicians in the UK by 2022.³⁵ Nesta are campaigning for 1 million new creative jobs by 2030.³⁶ The number of 18 year olds will also decrease by 8.9% between 2012 and 2022.³⁷ If we are looking to encourage students into STEM

careers why would we dissuade them from taking subjects that provide a clear route in? Similarly, encouraging a more diverse range of skills will benefit a creative sector, crying out for technical ability. IT, software and computer services expanded to be responsible for 46% of the GVA attributed to the creative industries by 2013 (up from 32% in 1997)³⁸. A STEAM education is the only education which will truly prepare students for our inevitably creative future, whether that be in the creative industries, or in a STEM career.

As a record maker, I sit at the fulcrum of arts and science. Without science, film, television, design, engineering, recorded music and the internet would be impossible. Without art and creativity, each and all of these disciplines would be very hard to use and even harder to enjoy. The marriage of art and science makes the full picture of any truly successful society.

Robin Millar, Record Producer

Design can play a unique role – providing a platform for interdisciplinary practice and a bridge between creativity and innovation. However in terms of structures and systems of support – it neither belongs firmly in STEM nor the arts – it so often falls between the gaps. The current educational policy fixation with EBacc subjects, that prioritises STEM subjects over (and in isolation from) creative subjects, is already having a less than positive effect on subjects such as Design & Technology.

John Mathers, Chief Executive, Design Council

When working in construction I especially enjoy the creativity involved in being part of a multidisciplinary team with architects, engineers and clients all striving to achieve the same goal - to construct projects that meet the requirements but also look beautiful.

In addition to being a Chartered Civil Engineer, I also achieved RIBA Part 1. Studying architecture helped me understand even better the importance of stimulating creativity and driving innovation. It has made me a better engineer.

Claire Gott, MBE CEng MICE, Chartered Civil Engineer, WSP and Founder of Cameroon Catalyst

What does studying Drama teach you? I learned dedication, the value of hard work and of approaching the task in hand with a clear purpose and full attention. I learned the ability to communicate with passion and confidence and to believe in myself. All necessary skills when working with people and looking to inspire others to get the best out of them - so important, whether you decide to be an actress, a businesswoman, a scientist, or an engineer.

*Nicola Mendelsohn, VP EMEA, Facebook and Chair,
Creative Industries Council*

Within education I believe that creativity isn't in the forefront, as it used to be. At GCSE and A-level, students are no longer encouraged to explore creatively and learn through doing so. This is a missed opportunity.

*Martin Darbyshire, Owner & Managing Director,
Tangerine*

To ensure our next generation is a generation of creators, schools must be encouraged to broaden their focus beyond science, technology and maths to include art, design and other creative subjects in a broad curriculum. Our economy needs creative problem solvers to face the challenges of the future - so we must invest today in training the artists, designers and engineers of tomorrow

Dr Vince Cable, Liberal Democrat politician

Notes

- ¹ Pomeroy, Steven Ross “From STEM to STEAM: Science and Art Go Hand-in-Hand”, Scientific American, 22 August 2012
- ² Sutch, Tom. “Uptake of GCE AS Level Subjects 2007–2013 Statistics Report Series No. 75.” Cambridge Assessment, June 2014.
- ³ We define ‘arts’ in line with Cambridge Assessment statistics as at AS/A Level: Applied Art & Design; Media: Communication & Production; Performing Arts; Art & Design (all variations); History of Art; Media/Film/TV studies; Film Studies; Music; Music Technology; Physical Education/Sports Studies; Dance. We define Creative Subjects as the above with the addition of Design & Technology (all variations) at AS/A Level. At GCSE we define Creative Subjects as Art & Design (all variations); Music; Drama; Dance; Design & Technology (all variations); Engineering; Engineering and Manufacturing (both replaced by Design & Technology if, as is proposed, the Design and Technology GCSE replaces the Engineering and Manufacturing GCSEs); Home Economics; Manufacturing; Moving Image Arts; Animation; Digital Photography; Expressive Arts; Film Studies; Media Studies; Performing Arts; Original Writing.

- 4 We define ‘arts’ in line with Cambridge Assessment statistics as at AS/A Level: Applied Art & Design; Media: Communication & Production; Performing Arts; Art & Design (all variations); History of Art; Media/Film/TV studies; Film Studies; Music; Music Technology; Physical Education/Sports Studies; Dance. We define Creative Subjects as the above with the addition of Design & Technology (all variations) at AS/A Level. At GCSE we define Creative Subjects as Art & Design (all variations); Music; Drama; Dance; Design & Technology (all variations); Engineering; Engineering and Manufacturing (both replaced by Design & Technology if, as is proposed, the Design and Technology GCSE replaces the Engineering and Manufacturing GCSEs); Home Economics; Manufacturing; Moving Image Arts; Animation; Digital Photography; Expressive Arts; Film Studies; Media Studies; Performing Arts; Original Writing.
- 5 “Five Tribes: Personalising Engineering Education.” Institution of Mechanical Engineers, December 2014
- 6 Holman, John. “Good Career Guidance.” The Gatsby Charitable Foundation, 2014.
- 7 “Enriching Britain: Culture, Creativity and Growth. The 2015 Report by the Warwick Commission on the Future of Cultural Value.” University of Warwick, February 2015.
- 8 Creative employment consists of employment with a high creative probability as explored by Bakhshi, Hasan, Carl Benedikt Frey, and Mike Osborne in “Creativity vs. Robots: The Creativity Economy and The Future of Employment.” Nesta, April 2015.
- 9 Bakhshi, Hasan, Carl Benedikt Frey, and Mike Osborne. “Creativity vs. Robots: The Creativity Economy and The Future of Employment.” Nesta, April 2015.
- 10 The creative economy consists of those creatively occupied (creative SOC codes) in other sectors and those in the DCMS defined creative industries (creative SIC codes). For further explanation please read Bakhshi, Hasan, Peter Higgs, and Alan Freeman. “A Dynamic Mapping of the UK’s Creative Industries.” Nesta, January 2013.
- 11 “Create UK- Creative Industries Strategy.” Creative Industries Council, July 2014.
- 12 As defined by DCMS: Advertising and marketing; Architecture; Crafts; Design (product, graphic and fashion design); Film, TV, radio and photography; IT, software and computer services; Publishing; Museums, galleries and libraries.
- 13 ‘Creative Industries worth £8 million an hour to UK economy. Press Release.’, Department for Culture, Media & Sport, 14 January 2014

- ¹⁴ A-Level students who are predicted ABB minimum and are applying to be supported through their civil engineering degrees by ICE and a civil engineering company sponsor.
- ¹⁵ Livingstone, Ian, and Alex Hope. “Next Gen: Transforming the UK in the World’s Leading Talent Hub.” Nesta, February 2011.
- ¹⁶ Sutch, Tom. “Uptake of GCE AS Level Subjects 2007–2013 Statistics Report Series No. 75.” Cambridge Assessment, June 2014.
- ¹⁷ Sutch, Tom. “Uptake of GCE AS Level Subjects 2007–2013 Statistics Report Series No. 75.” Cambridge Assessment, June 2014.
- ¹⁸ “Enriching Britain: Culture, Creativity and Growth. The 2015 Report by the Warwick Commission on the Future of Cultural Value.” University of Warwick, February 2015.
- ¹⁹ “Enriching Britain: Culture, Creativity and Growth. The 2015 Report by the Warwick Commission on the Future of Cultural Value.” University of Warwick, February 2015.
- ²⁰ “Engineering UK 2015: The State of engineering” Engineering UK, 2015
- ²¹ Bakhshi, Hasan, Carl Benedikt Frey, and Mike Osborne. “Creativity vs. Robots: The Creativity Economy and The Future of Employment.” Nesta, April 2015.
- ²² “Taking Part 2011/12 Adult and Child Report Statistical Release.” DCMS, August 2012.; “Taking Part 2013/14 Adult and Child Report Statistical Release.” DCMS, July 2013. “Enriching Britain: Culture, Creativity and Growth. The 2015 Report by the Warwick Commission on the Future of Cultural Value.” University of Warwick, February 2015.
- ²³ “Taking Part 2013/14 Adult and Child Report Statistical Release.” DCMS, July 2013. via <http://www.telegraph.co.uk/news/politics/11008822/Steep-fall-in-primary-school-children-taking-part-in-arts-clubs-since-2010.html>
- ²⁴ Cairns, Sam. “English Baccalaureate Research: January 2013.” Cultural Learning Alliance, January 2013.
- ²⁵ Sutton Trust, Research Brief: Extra-Curricular Inequality, September 2014 <http://www.suttontrust.com/wp-content/uploads/2014/09/Extracurricular-inequality.pdf>
- ²⁶ “Evaluation of Find Your Talent Programme”, IPSOS Mori, DfE, DCMS, London <http://dera.ioe.ac.uk/2372/1/DFE-RR089.pdf>
- ²⁷ Winner, Ellen, Thalia Goldstein, and Stéphan Vincent-Lancrin. “Art for Art’s Sake: The Impact of Arts Education.” OECD, 2013.
- ²⁸ Winner, Ellen, Thalia Goldstein, and Stéphan Vincent-Lancrin. “Art for Art’s Sake: The Impact of Arts Education.” OECD, 2013.

- ²⁹ Enriching Britain: Culture, Creativity and Growth. The 2015 Report by the Warwick Commission on the Future of Cultural Value.” University of Warwick, February 2015.
- ³⁰ ‘Big Bang for Maths and Science, Damp Squib for Design and Technology. Press Release’, The Design and Technology Association, March 2015
- ³¹ <https://www.gov.uk/government/news/new-arts-gcses-to-be-introduced-in-2016>
- ³² Winner, Ellen, Thalia Goldstein, and Stéphan Vincent-Lancrin. “Art for Art’s Sake: The Impact of Arts Education.” OECD, 2013.
- ³³ “Key Research Findings: The Case for Cultural Learning.” Cultural Learning Alliance, 2011.
- ³⁴ “Five Tribes: Personalising Engineering Education.” Institution of Mechanical Engineers, December 2014
- ³⁵ http://www.nwed.org.uk/uploads/2/6/1/1/26111168/careers_infographic_poster_a3_fin.pdf
- ³⁶ Bakhshi, Hasan, and George Windsor. “The Creative Economy and the Future of Employment: Why the UK Needs 1 Million New Creative Jobs by 2030 and What the Government Can Do about It.” Nesta, April 2015.
- ³⁷ “STEM Graduates in Non STEM Jobs.” BIS, March 2011; <http://www.theguardian.com/commentisfree/2014/aug/16/engineers-lifeblood-country-uk-students-science-maths-a-level>
- ³⁸ <http://bop.co.uk/blog/culture-and-creative-industries/going-beyond-lip-service-on-the-economics-of-creativity>

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