

# Inspiring the next STEM generation



Why are children turned off STEM subjects at school and what can be done to encourage more of them to continue to study? This was the issue discussed by a panel of experts at the 'Inspiring the next STEM generation' debate, chaired by GL Assessment, during the London Festival of Education 2012.

The timely debate followed high-profile warnings made earlier this year that the UK is facing a skills crisis as not enough children are sticking with Science, Technology, Engineering and Maths (STEM) subjects at school and this is having a knock-on effect on the economy.

In July, The House of Lords Science and Technology Committee advised the Government that it will fail to drive economic growth through education and hi-tech industries, unless it takes immediate action to ensure young people study STEM subjects and recommended that maths should be compulsory for all students post 16.

Nigel Whitehead, Group Managing Director of BAE Systems, backed up their warning when he revealed that just ten per cent of people in the UK study STEM subjects beyond the age of 16, when 60 per cent of UK jobs over the next decade will require STEM skills.

The high-profile speakers brought together to discuss this topic at the GL Assessment event included Professor Alison Wolf of King's College London, the author of *The Wolf Report*; an independent review of vocational education published this year. She was joined by Kirsten Bodley, Chief Executive of STEMNET; Adie Howell of the Academies Enterprise Trust; Mark Wilkinson OBE of Mark Wilkinson Furniture; and Helen Ward from the Times Educational Supplement. The discussion focused on how schools can identify STEM learners and teach to their strengths.

The panel considered what should be done to encourage STEM learning at both primary and secondary schools and looked at how we can address the shortage of STEM skilled staff in the workplace. What follows is a summary of the key points made by the speakers.



## Identifying STEM learners

Research has shown that it is spatial learners who often excel at STEM subjects. For example, Project Talent in America followed around 400,000 pupils over a 50-year period and found that those who had high scores on spatial tests were much more likely to follow STEM careers.

However, spatial learners can often be sidelined in school and pushed towards more manual subjects and professions, as their potential remains unidentified through a lack of awareness.

This was certainly the experience of one of the panel speakers, Mark Wilkinson OBE of Mark Wilkinson Furniture and Smallbone of Devizes, a leading UK designer and employer, who is a spatial thinker. "When I was at school, neither I nor, to the best of my knowledge, my teachers had any understanding of dyslexia let alone spatial thinking," he said.

"I was consigned to the D stream in the local secondary modern school, the rowdiest place to be. The educational experience was, for me, vile, violent and humiliating; indeed an altogether lonely experience."

## What is spatial thinking?

A spatial thinker is simply someone who thinks most easily by using images and only afterwards converts these thoughts to words; someone with a capacity for mentally generating and transforming visual images.

"I guess it was a bit like being in a Marvel comic; with more pictures than words," said Mark, who remembered; "At school I would practise being present but absent. I would sit near the window and just stare out. The teachers thought I was dumb, but I found it utterly absorbing.

"I was actually changing the pictures in my mind, changing the playgrounds into fields, the fences into hedges, it taught me the creative 'technique' I use today. People say it looks as though I am staring into space, but actually I am forming a shape, perhaps a table, perhaps a handle, building a picture, in complete 3-D, inside my head, before the design hits the drawing board. At school, staring through the window convinced my teachers that I was an absolute no-hoper."

These days, psychologists acknowledge that spatial thinking is one of the basic

mental tools we all have and need to use. However, too often children are either unaware that they have a strength in this basic mental ability, or they are dismissed by schools as merely being 'good with their hands' or 'gifted at art'.

According to Dr Jonathan Wai, psychologist and research scientist at Duke University, North Carolina, schools are neglecting those with spatial intelligence for three main reasons:

- Teachers are more comfortable with verbal thinking.
- Spatially talented people are not very vocal (both Edison and Einstein were spatial thinkers, known to be poor talkers who spoke rarely and even then with much hesitation).
- Standardised tests conducted in schools do not typically include spatial measures.

## If at first you don't succeed

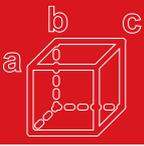
"I am uneasy at the idea that to be a spatial learner is to be, by definition, not good at the other aspects of education," Professor Alison Wolf told delegates.

Professor Wolf believes that it can be easy for schools to give up on students too quickly if they do not appear to show a natural aptitude for a subject. "It is not that we don't identify natural talent but that we have assumed that if natural talent isn't there it's fine to give up on it. And so this relates to my unease; that if you identify strong spatial talents in a young person, you also say, 'Right, they belong out of the classroom.'"

"Because it seems to me that in many respects, yes, you have natural talents for things, but that's often as much about how long it takes you to learn something as it is about whether you can learn it at all," she added.

"And one of the things that I said in my review, and about which I feel completely unapologetic, is that anybody who doesn't have a maths level A to C at 16 or anybody who doesn't have English A to C at 16 but who stays in full time education must go on working on those subjects."

Professor Wolf pointed out that less than half of UK 16-year-olds currently achieve Maths and English at GCSE A to C and this figure only increases to 53 per cent among



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those who remain in full time education up to 18. She blames the way post-16 education has been organised, and especially financial incentives for this – but most of all she thinks pupils should be encouraged to keep on trying.

“I feel very strongly that, yes, you need to incentivise people, you need fantastic teachers, you need to have wonderful methods and different ways of doing things, but you also have to say, ‘Okay, well if you don’t get there straight away, carry on doing it.’ And that is actually the major difference between us and the rest of the world, that we allow people to give things up because we tend to assume that if they can’t do them very well, they should just be allowed to go in another direction.”

**Get it right from the start**

Helen Ward, primary reporter at the Times Educational Supplement, specialises in maths education. She highlighted the point where children in the UK seem to lose their love of the subject. “One of the most startling things is that when you ask children who are starting off in school aged five or six what their favourite subjects are, maths is right up there; they love it. But if you ask them again when they leave at age 11 many of them hate it and their confidence has gone.”

Why are these children losing their confidence so early? “One of the biggest barriers children face is the idea that you must be naturally talented at maths or there is no point trying,” said Helen. The die can be cast very early and irrevocably. At the end of primary, 94% of those children who have reached the expected grade will all go

on to get a C in GCSE, but 90% of those who are struggling at that age will then go on and fail their GCSE.

The answer therefore is to stop branding maths as too difficult and to be careful to avoid giving children the impression that it is a subject you need a special ability to succeed at. “We need to acknowledge that maths is hard but it is achievable and essential,” said Helen. “And conversations about maths, whether at home, on TV, or in newspapers need to point out that maths isn’t scary, it’s something everyone can get a grip on.”

The other issue is ensuring that maths captures children’s imaginations. Helen told the audience that Whitehall sometimes misses the point when it focuses on the use of Roman Numerals or calculators in maths teaching. She quoted US maths teacher Paul Lockhart who said in his essay, ‘The Mathematician’s Lament’:

“All this fussing and primping about which topic should be taught. It’s re-arranging deckchairs on the Titanic. The main problem with school maths is there are no problems.”

“This idea of problem solving being key to learning maths comes up again and again,” said Helen. “It was in two reports on Ofsted this year, the EYFS review and the ACME response to the curriculum. ‘We need problems,’ they say, ‘because that is what maths is about, that is what engages your children, and it’s the kind of maths that we as a society need.’”

The key part of learning through problem solving isn’t about getting the right answer she pointed out – although that is always

good. It is about being able to find a way to the answer; being confident enough to risk making mistakes.

“So what flies around Whitehall are arguments about calculators and tables, data handling and long division, the grid method, chunking, column addition,” Helen told delegates. “But the question of how to help children do better at Maths, is being played out quite differently in classrooms. There, teachers and researchers are coming up with engaging problems and ways to boost confidence in creativity,” she concluded.

**Inspire through example**

Kirsten Bodley is Chief Executive of STEMNET, an organisation that creates opportunities for young people to be inspired in science, technology, engineering and maths. She spoke about how they are achieving this.

“What we are all about is widening young peoples’ chances and choices through the opportunities that these subjects offer them. It’s about helping them develop their life skills and their employability skills,” she said. “And the beauty of these sorts of activities is it helps all types of learners, especially spatial type learners because this isn’t about traditional learning in the classroom.”

STEMNET provides free advice to teachers and schools about activities that can benefit young people and teaching staff, such as STEM Clubs and the STEM Ambassadors Programme.

“We work with about 3500 employers and our unique area really is linking employers to



schools for projects as well as presentation talks and careers advice,” said Kirsten. “A real benefit for spatial learners is that this is about practical projects, real world challenges and real world applications, and not necessarily about rote learning.

“Our flagship programme is the STEM Ambassador’s Programme, where we have



25,000 volunteers from business and industry, to really enthuse young people about these subjects. We have environmental scientists, including a polar explorer, pharmacists, physicists, civil engineers, mathematicians, accountants, and more and 25 per cent of our ambassadors actually come through an apprentice background which is something we increasingly support,” said Kirsten.

“I should also say that 40% of our ambassadors are female which is an incredibly high percentage compared to the working population in STEM sectors, so this is all about providing role models to raise aspirations of all young people. A lot of young people we come across aren’t aware of the types of careers available to them, or that they don’t need PhDs to become an engineer or a scientist. In fact, there was one young girl at an event quite recently who met one of our female ambassadors and commented that she didn’t realise scientists could be married with children.”

STEMNET also runs a second programme

advising on after-school clubs related to STEM subjects but not necessarily consisting of purely physics, chemistry or computing. “It’s not about writing, reading or testing, it’s about having fun outside the classroom and doing practical things you might not have a chance to do in the classroom, and this goes for staff as well,” said Kirsten.

“It isn’t about attainment, although we know that it does support young people attaining. It is about giving all learners, especially spatial learners, the benefit of being able to do things in a very non-traditional way. We are calling on every secondary school in the UK to actually have some sort of STEM-related club to which their pupils can join,” she said.

#### Turn STEM skills into jobs

The Academies Enterprise Trust is the largest academy sponsor in the UK, responsible for 66 primary, secondary and special academies, in some of the most deprived areas of the country.

Adie Howell, the Employability Pathways Manager, is establishing AET’s innovative in-house apprenticeship scheme. He spoke about how the programme has made him conscious of the difficulty in identifying learners with the right skills to excel in STEM careers.

“We want to dramatically increase the range of employment and help the communities that we serve,” he told delegates. “To this end, we have recently begun to offer apprenticeships within our academies which offer quality training to young men and women who have previously struggled to find a solid first step on the career ladder.”

AET previously created apprenticeships through its business links with other sectors, but now it will employ directly, with the recruitment of 80 apprentices in its academies this year, initially within business administration and IT support.

“One challenge we face is finding accurate ways of evaluating our apprentices’ potential during their initial assessment,” Adie said. “We have been able to assess the verbal and non-verbal abilities of our students to see what learning approach

benefits them most and this has allowed our academies to identify which students are most likely to achieve, particularly in STEM subjects.

We are now working towards a comprehensive method of profiling our apprentices too. The more we can do to promote the value of STEM qualifications, the better for employers everywhere,” he concluded.

GL Assessment has published a new edition of the *Cognitive Abilities Test (CAT)*, the UK’s most popular test of reasoning abilities for children aged seven – 16 years. The new edition of the test contains a greater emphasis on uncovering spatial learners.

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