Education research

Evaluation of the Wellcome Trust Camden STEM Initiative

Executive summary
June 2012

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Introduction

This report presents the findings of an evaluation of the Wellcome Trust's Camden science, technology, engineering and mathematics (STEM) Initiative, which provided funding to eight Camden schools to develop interdisciplinary projects. Projects spanned the two academic years 2009/10 and 2010/11, with most schools starting planning and delivery in the spring and summer term of 2009. Two key delivery models were used:

- the development and piloting of new schemes of work
- the development and delivery of enhancement and enrichment activities (e.g. a themed day or series of themed days, a dedicated STEM week, after-school STEM clubs, visits out of school and visits in school from STEM Ambassadors).

The schools that focused their energies on developing new schemes of work often also delivered STEM enhancement and enrichment activities.

Background to the Camden schools and their projects

The background of the eight participating schools varied in terms of their type, the characteristics of their intake and their attainment levels. School types included mixed and single sex, comprehensive and special, and there were varied specialisms – from music and arts to science with mathematics. The percentage of pupils eligible for free school meals, a measure of socioeconomic status, ranged from 17 to 69 per cent, and the percentage of young people identified as having special educational needs ranged from 8 to 50 per cent in the seven mainstream participating schools. The standard measure of attainment, five GCSEs at grades A* to C including English and mathematics, ranged from 37 to 76 per cent across the seven mainstream schools, against a national average of 55 per cent.

Project delivery and progress

The Wellcome Trust gave schools a small grant (£10 000 over two years) and the freedom to devise a project that fitted their current stage of development in relation to STEM and individual needs. As a result, schools delivered a wide range of projects with different scope and foci. The money provided was used to pay for:

- additional responsibility payments for staff
- staff to run after-school activities
- supply cover to enable staff to work together to plan activities
- new resources, materials and equipment (e.g. data loggers, medical equipment, materials to build a wind turbine and solar heating panels)
- professional development for teachers
- pupil trips and visits from external speakers and facilitators.

Schools' progress in the first year was very good given that interdisciplinary STEM work had not previously been explicitly supported. All schools continued to successfully deliver a wide range of STEM activities in the second year of the project, targeted mostly at Key Stage 3 pupils, although there have been some challenges in delivering all the activities originally planned.

Schools varied in their arrangements for leading and managing their projects, and some changes to the leadership and management took place over the second year.

Outcomes

The STEM Initiative resulted in a range of important outcomes for pupils, teachers and schools.

The outcomes for pupils included:

- raised awareness of, and engagement in, STEM subjects
- learning new things in different ways (e.g. through exposure to outside professionals, and trips to careers events and STEM-related organisations and museums)

- increased enjoyment of STEM subjects (e.g. through their involvement in contextualised 'real world' and practical activities and being given greater freedom to use their own initiative and be creative)
- development of transferable skills useful for future study and employment (such as communication, teamwork, problem solving, planning and organisation, research, and time management)
- increased understanding of the links between the STEM subjects, especially between mathematics and other STEM subjects (including an awareness that they are linked together in the world of work and within STEM careers)
- increased understanding of the importance of STEM subjects for work and life in general (this was most pronounced for mathematics)
- greater awareness of STEM careers and what they involve (often achieved through the input of outside professionals)
- increased interest in STEM study and careers.

Some teachers and pupils have also tentatively suggested that pupils' increased interest in and motivation to learn the STEM subjects will lead to higher attainment.

The pupil outcomes highlighted above primarily relate to the enhancement and enrichment activities that pupils have been involved in, as the delivery of new schemes of work is still at an early stage. In most schools, these outcomes have been achieved for whole year groups – mainly Key Stage 3 – but in some cases, the target group has been gifted and talented pupils.

The outcomes for teachers included:

- improved relationships with staff in other STEM departments, especially for the designated STEM leads
- increased awareness of the curriculum in other STEM subjects and potential links, most evident in schools focusing on changes to schemes of work
- increased confidence in undertaking interdisciplinary projects
- new learning and skills (e.g. from undertaking practical and applied and teamwork activities)
- higher expectations of what pupils can achieve, particularly in relation to topics pupils usually find difficult
- increased enjoyment and enthusiasm (e.g. through being given the opportunity to be more innovative and creative with the curriculum).

The outcomes for schools included:

- increased awareness of and commitment to interdisciplinary STEM activity among senior leaders and staff in general

- closer links between the STEM departments at teacher level and increased formalisation of cross-departmental working
- increased confidence of teachers in cross-departmental working
- a perception of improved staff retention through new challenges and professional development.

In relation to the sustainability of these early outcomes, it is important that – where the focus of schools is on enhancement and enrichment activities rather than embedding changes in schemes of work – pupils experience ongoing opportunities to engage in these types of interdisciplinary activities (e.g. at least once a term).

What is working well

Schools identified several key areas in which aspects of their projects worked well and described several features of each of them that ensured the success of the project.

Senior leadership commitment to and support of the STEM agenda

- the commitment of senior leaders to the STEM agenda and their support of staff and activities are of key importance, particularly for the sustainability of activities.

Management and staffing

- having a designated STEM Coordinator or STEM leads in each department who take responsibility for the work; ideally, these staff should receive a responsibility payment, share the workload and engage other staff from across the STEM departments
- allocating staff to the work who are passionate about STEM
- ensuring that the staff involved feel that their work is appreciated and valued
- having a clear action plan that outlines roles and responsibilities, aims, objectives, activities and timescales, and outcomes (particularly outcomes for pupils) and details how progress will be tracked
- providing regular information to staff and sharing learning and resources so that they are clear about their role in the project and the delivery of lessons and activities is made as easy as possible
- having an openness and enthusiasm for doing things differently and an appetite for innovation
- making clear the benefit to teachers in terms of their own professional development to help ensure they are motivated to take part
- putting in place administrative support to speed up progress.

Regular meetings and planning time

- having regular, designated time off-timetable for planning or paying for supply cover to allow meetings to take place in school time, without which sustainability is likely to become an issue.

Promotion and publicity

- developing and maintaining a high profile for STEM in schools ensures that pupils are engaged with the work; this should be done in a range of ways, including the use of notice boards and assembly time.

Delivery

- practical activities, group working, problem solving, researching and debating have been found to work particularly well. Pupils also find activities engaging when they are set within real-life contexts, and this was particularly successful in mathematics where it helped pupils to see the relevance of what they were learning
- teachers running the activities should be confident in doing so, and teachers who are less confident should be properly supported
- using outside professionals to lead or support activities can be very effective – providing pupils with greater insights into STEM careers, enthusing them about STEM more generally and providing them with positive role models
- older students delivering activities, with their views often influencing those of younger children
- being properly resourced, with the necessary materials and equipment – the Wellcome Trust funding has been particularly appreciated in this regard
- taking pupils off-timetable for participation in enrichment activities: this is less complicated logistically than delivering them within the existing timetable and allows more to be achieved with the entire day solely focused on STEM
- taking advantage of the increased flexibility within the curriculum at Key Stage 3 to deliver enrichment activities and develop schemes of work. It is particularly beneficial to provide a STEM 'boost' to pupils in Year 9 before they make their GCSE choices
- gathering feedback from pupils regarding what is and is not working, how they are benefiting and what could be improved
- starting small and developing the programme gradually.

Examples of successful activities included: mapping schemes of work to identify the links between the subjects; teaching the Key Stage 4 curriculum in an entirely interdisciplinary way; STEM homework exercises; STEM enhancement and enrichment activities (including STEM clubs) on a range of themes; the use of the school garden for experiments and data collection and analysis; the use of pre-prepared and external resources; a STEM quiz in the

school diary; adaptations of PowerPoints so they included a STEM logo to indicate when links with other STEM subjects were being made; and staff in STEM departments working together at options evenings to encourage further STEM study.

These are just some of the activities undertaken and demonstrate the diversity of things that encourage STEM interdisciplinary activity, some of which require low-level buy-in in terms of staff time, school commitment and money, and some of which require a higher level of buy-in.

What challenges and barriers are being faced?

Challenges were identified in several key areas.

Senior leadership commitment/strategic vision

Change proved difficult within schools where STEM does not feature among senior leaders' priorities or have their support. A lack of a strategic vision for STEM and clarity in terms of accountability for STEM were also identified as significant barriers.

People

Challenges associated with people included securing staff buy-in, developing staff capacity (confidence, knowledge and skills) and coping with staff turnover. Explicit and practical support from senior leaders can mitigate staff-related challenges, but the absence of support can compound them.

Resources

Resource shortfalls were consistently identified as a challenge in developing and delivering new work and new ways of working. The crucial resource was staff time: protected, off-timetable time was needed for key players (e.g. STEM leads) and, ultimately, for the wider staff body, for changes in culture and practice to be secured.

Processes

Several processes were identified as complicating and sometimes impeding STEM work, including timetabling or scheduling different activities (e.g. topics, lessons, examinations and departmental meetings).

Integration of STEM subjects

Relatively few challenges specific to the integration of STEM subjects were identified, and interviewees seemed relatively confident that these challenges could be surmounted or worked around.

Future plans and sustainability of STEM

Future delivery of STEM

At the end of year 2 of the STEM Initiative, two schools had spent the full grant received from the Wellcome Trust and six schools had funds remaining. In the short term, all six schools with funds remaining expect to use this resource to continue to deliver STEM activities. In the longer term, six schools expected to repeat or develop activities that had already been delivered; two of these schools also anticipated delivering additional activities.

Sustainability of STEM

In two schools, there were no longer-term plans to sustain STEM interdisciplinary activities. In the remaining six case study schools, there were indications that STEM interdisciplinary activities will be sustained beyond the lifetime of the STEM Initiative.

This was particularly true in the three schools that had plans to deliver additional activities or included STEM in strategic or operational plans. Schemes of work had been a key focus of activity in these three schools.

Factors that support sustainability

The most frequently cited factors considered to strengthen the sustainability of interdisciplinary STEM activity are senior leadership support, the provision of time off-timetable for relevant teaching staff, funding for payments to staff or for supply cover, and the perception that STEM interdisciplinary activities can support a school's achievement of its attainment or improvement targets.

Conclusions

Overall, demonstrably impressive progress has been made by all eight schools throughout the two years of the Camden STEM Initiative, benefiting pupils, teachers and schools. There is substantial evidence of very effective collaborative and participatory practice in delivering STEM interdisciplinary activities. It is hoped that other schools will benefit from the two key elements identified as enabling interdisciplinary STEM activity. The first element is a commitment to STEM throughout the school – including in its organisational structure, staffing and school development plan. The second main element of successful interdisciplinary STEM activity is that it is delivered through a variety of different activities and resources, some requiring a low level of buy-in and commitment (which can be used to initiate change) and some requiring greater levels of organisation – from the use of logos on PowerPoints that indicate to pupils when they are using a skill that will be applicable in other STEM subjects to the use of external experts and rewriting schemes of work.

In conclusion, a substantial amount of impressive and impactful interdisciplinary STEM activity has been delivered through the STEM Initiative. Every school has developed and progressed interdisciplinary STEM activity and can evidence achievements in this respect. Furthermore, there are reasonable and, in some cases very strong, indications that six of the eight schools will sustain STEM activities beyond the lifetime of the STEM Initiative.

Wellcome Trust

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