



**CEDEFOP**

European Centre for the Development  
of Vocational Training



Education and Culture DG  
Lifelong Learning Programme

## Study visit group report

<b>Group No</b>	225
<b>Title of the visit</b>	Cross-curricular application of mathematics for 4-to-16 year-olds in England
<b>Topic</b>	Learning Mathematics and Science
<b>City, country</b>	Solihull, England, United Kingdom
<b>Type of visit</b>	General education
<b>Dates of visit</b>	11/03/13 - 15/03/03
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### I FINDINGS

1. One of the objectives of the study visits programme is to exchange examples of good practice among hosts and participants. Cedefop will select well-described projects/programmes/initiatives and disseminate them to former participants and a wider public, including potential partners for future projects. Therefore it is important that you identify and describe all aspects that, in your view, make these projects/programmes/initiatives successful and worth exploring.

Describe each of the good practices you learnt about during the visit (both from the hosts and from one another) indicating the following:

title of the project/programme /initiative	country	name of the institution that implements it (if possible, provide a website)	contact person (if possible) who presented the programme to the group	whom the project/ programme/ initiative addresses	what features of the project/programme/initiative make it an example of good practice
MaST	UK	Edgehill University <a href="https://www.edgehill.ac.uk/study/courses/specialist-primary-mathematics-practice">https://www.edgehill.ac.uk/study/courses/specialist-primary-mathematics-practice</a>	Cathryn Hardy	Primary teachers	Training programme with a mix of face-to-face, online and in-school experiences to ensure there is a specialist teacher who will “champion maths” in every primary school as recommended in a review of maths teaching in the UK.
STEMNet, part of the national STEM (Science, Technology, Engineering and Maths) initiative	England	University of Birmingham (one of the contracted providers) <a href="http://www.stemnet.org.uk/regions/1636">http://www.stemnet.org.uk/regions/1636</a>	Julia Kingston	Primarily secondary schools but also primary schools; university students who act as ambassadors	STEM Ambassadors - places volunteers in classrooms to promote science, technology, engineering and mathematics professions by leading interactive lessons STEM Clubs - emerging network of school-based extra-curricular clubs
NRich	UK	University of Cambridge <a href="http://nrich.maths.org/frontpage">http://nrich.maths.org/frontpage</a>		Primary and secondary students	Provides free enrichment material developed by teachers that focuses on a problems-based approach to maths intended to lead to higher-order thinking as well as professional development for teachers. NRich also provides puzzles and activities for children to use independently via a website.
National Centre for Excellence in the Teaching of Mathematics	England	<a href="http://www.ncetm.org.uk">www.ncetm.org.uk</a>		Primary and secondary teachers	Organises continuing professional development for teachers and an online forum for the sharing of good practice. The Centre also funds teacher-led research. The Centre also publishes magazines targeting teachers at various levels.
BLP (Building Learning Power)	UK	<a href="http://www.buildinglearningpower.co.uk">www.buildinglearningpower.co.uk</a>	Professor Guy Claxton	Students of all ages	A programme intended to help people develop aptitudes that promote good

					learning, specifically resilience, resourcefulness, reflectiveness and reciprocity. The organisation provides resources and materials for teachers.
MINT	Germany	<a href="http://www.biodidaktik.uni-halle.de/projekte/mint_halle/?lang=en">www.biodidaktik.uni-halle.de/projekte/mint_halle/?lang=en</a>		All ages	School laboratories, media integration, research lessons to promote natural science, mathematics and technology education.
SINUS (linked with FIBONACCI)	Germany	<a href="http://www.sinus-transfer.eu/">www.sinus-transfer.eu/</a>	Dagmar Raab, University of Bayreuth	Secondary students	Promoting discovery and independent learning using open tasks.
Primary Mathematics Support Team	Malta	<a href="http://primarymaths.skola.edu.mt">primarymaths.skola.edu.mt</a>	Melanie Casha-Sammut	Primary teachers	Cooperative teaching and planning - training for teachers situated in the school, supporting primary class teachers. One of the key priorities is generating a positive attitude towards maths.
e-books for mathematics and science (an EU funded project)	Slovenia	<a href="http://www.e-um.si">www.e-um.si</a>		Primary and secondary students and teachers	The development of a series of new electronic textbooks
Teacher training for current practicing teachers (40,000 to be trained)	Sweden	<a href="http://www.skolverket.se">www.skolverket.se</a>			An initiative to provide upskilling for all practicing teachers in the area of mathematics to ensure great confidence and awareness of how to teach maths concepts, with the goal of training 40.000 teachers.

\* You can describe as many good practices as you find necessary. You can add rows to the table.

2. The study visits programme aims to promote and support policy development and cooperation in lifelong learning. That is why it is important to know what you learnt about such policies and their implementation during your visit. You are invited to describe your findings concerning the following:

This study visit involved participants from a variety of countries. It is important to clarify that the participants shared practice based on their own unique experiences and settings, recognising that many countries have federal systems regarding education or educational authority models that assign a significant level of autonomy to individual schools which can create substantive differences between regions and schools within a single country. Therefore, this report does not always specify a specific country when an approach may not be universal but rather unique to an individual's context.

**2.1 APPROACHES TAKEN BY PARTICIPATING COUNTRIES (BOTH HOST AND PARTICIPANTS') REGARDING THE THEME OF THE VISIT. ARE THERE ANY SIMILAR APPROACHES/MEASURES IN PARTICIPATING COUNTRIES? WHAT ASPECTS ARE SIMILAR AND WHY? WHAT ASPECTS ARE DIFFERENT AND WHY?**

**Practical, contextual application of maths skills using a cross-curricular approach**

The group valued hands-on, task-based learning opportunities that develop higher-order thinking skills and help learners see the connection between maths and everyday life. Universally, the participants, as well as the representatives from the host country, are striving to develop ways of exploring maths from a cross-curricular and contextualised approach. Examples of the following activities and programmes illustrate this:

- STEM Ambassadors and Clubs (UK)
- MINT (Germany)
- SINUS (Germany)
- Cross-curricular planning tools (UK and other countries)
- Maths trails (Malta, Ireland, Bulgaria and other countries)
- Outdoor learning or forest schools (UK and Sweden)
- Contextualised, practical maths applications (e.g. planning a hypothetical holiday, comparing mobile phone plans, etc.)
- Child-centred inquiry - children's interest and curiosity as inspiration for investigations, typically in early childhood and primary programmes (Belgium and Sweden)
- Linkages with local businesses to provide contextualised maths practice

**Increasing motivation by making explicit the value of different skills as applied to practical tasks**

In comparing the various approaches to maths teaching, it is agreed that it is valuable and important for children to understand why there are learning maths skills. This builds a good sense of purpose for using maths and makes it valuable and applicable.

**Foundation in basic skills remains important**

Though practical tasks are highly valued, the study visit participants shared examples and witnessed various approaches intended to ensure children develop

their basic skills. While investigations and contextualised tasks are essential in motivating pupils and developing their higher-order thinking skills, a careful balance between foundational skills and creative approaches to applying them is required.

### **Range of experiences regarding the number of adults working in the learning environment and ways of structuring the learning environment**

The study visit participants concluded that maximising the number of adults available to support learning in a classroom is invaluable. Participants visited various schools and witnessed very favourable pupil-adult ratios (7 adults working with a group of 70 young children, for example). The presence of teaching assistants was observed regularly, with many in the group arguing that additional qualified adults are more valuable than a smart board or other technology tools. Another example of a favourable option for promoting small-group work is the use of small groups in the 8<sup>th</sup> and 9<sup>th</sup> classes in Slovenia for maths, Slovene and English. In other contexts, it was felt that the number of teaching assistants available was limited and the role could be expanded and made universal, especially in Ireland, Belgium and France. In some settings, older students, parents and volunteers can bridge the gap, a practice in some of the UK schools we visited. As another example, parents lead station-teaching activities in Ireland. There were concerns about parents not recognising boundaries for involvement, specifically that parents' might interfere and not respect the role of the teacher. This would require careful guidance and management by the teacher to emphasise he or she retains the professional role of learning facilitator. Therefore, the use of parents and volunteers in the classroom is dependent on the local ethos present in a school or educational authority. The participants agreed that parental involvement can lead to better links between home and school and that there is value in parents observing lessons or participating in activities under the direction of teachers and school leaders. In Malta a substantial number of workshops for parents are also being organised to further support parents, and these are always well attended.

### **Moving beyond use of a single textbook or scheme**

While most of the schools we visited did retain a textbook or scheme, there was a strong move towards complementing this with a wide range of activities. It was agreed that good maths planning is much more than just choosing one textbook or method. Instead a combination of approaches and methods that achieve many targets is best. All participants spoke about moving away from reliance on a single textbook in their own contexts, with some participants having done away with a single textbook entirely in favour of individualised work. The use of interactive whiteboards and IT support can play a major role, with interactive whiteboards now a universal resource in many settings.

### **Promoting self-assessment and the development of effective learning skills**

The group witnessed a practice in some of the primary and secondary schools in the UK that all children are presented with the learning intention or learning objective at the beginning of the lesson. More importantly, not only are the pupils aware of their learning targets from the outset but also self-assessment is a core part of the learning process in the UK schools we observed. This process of self-assessment is in place not just at the end of a lesson but throughout the lesson. There has been a positive move from seeing objectives as what the

teacher expects the child to be able to do towards what the child perceives him or herself as being able to achieve. A variety of methods for children to reflect on their learning were shared including written reflections, talking with another child, hand signals, symbols, etc.

### Linking with the local community

Many schools in the UK, as well as Germany and other settings, create links with local businesses, banks and shops. While this is seen as a great way to apply maths skills in contextualised situations, the participants expressed concern at the potential of corporations sponsoring schools financially.

#### 2.2 CHALLENGES FACED BY PARTICIPATING COUNTRIES (INCLUDING HOST) IN THEIR EFFORTS TO IMPLEMENT POLICIES RELATED TO THE THEME OF THE VISIT. WHAT ARE THE CHALLENGES? ARE THEY COMMON CHALLENGES? IF SO, WHY? IF NOT, WHY NOT?

Several common challenges were identified.

1. Many children continue to have difficulties with procedures and applying mathematical reasoning to unknown situations.
2. Problem-solving proves challenging for many pupils, suggesting language development can be an undervalued aspect of supporting good maths learning.
3. Schools struggle to adapt from traditional approaches, particularly moving away from textbooks as a sole teaching resource, and to plan more practical or contextualised activities.
4. The type and quantity of resources available varies.
5. Some participants highlighted the problem of motivating pupils and ensuring there is a positive attitude for maths, though this was not universal in every setting and in every age group.
6. Valuing and promoting creativity presents a challenge.
7. High-stakes testing regimes, particularly in the host country but elsewhere and especially as children get older, lead to a limited focus regarding the comprehensive numeracy abilities of children.
8. While there are changes made to curricula or exam formats that favour functional use of maths skills, such reforms are not always supported properly with adequate teacher preparation or the gathering of appropriate teaching exemplars and sample materials to ensure success.

#### 2.3 NAME AND DESCRIBE EFFECTIVE AND INNOVATIVE SOLUTIONS YOU HAVE IDENTIFIED THAT PARTICIPATING COUNTRIES (BOTH HOST AND PARTICIPANTS) APPLY TO ADDRESS THE CHALLENGES MENTIONED IN QUESTION 2.2. PLEASE MENTION SPECIFIC COUNTRY EXAMPLES.

A cross-curricular approach, being applied in many of the host country's schools, has led to a greater sense of purpose for maths among the pupils. This appears to have been more successful at the primary level, both in the UK and other countries, than at the secondary level where there are specialist teachers who do not traditionally have the opportunity for collaboration or experience with common planning.

Relating maths to real-life and concrete situations makes for better maths and thinking skills. This is especially true through **practical or contextualised tasks that require group problem-solving** (NRich in the UK, SINUS in Germany, etc.)

The practice of **presenting children with different computation methods or algorithms varies**. In UK, Portugal and Malta teaching different methods and strategies is common as well as in Bulgaria among young children. Schools in Ireland, France and Germany tend to emphasise one method. The participants felt the presentation of different methods was good practice, as some methods are very effective for developing mental maths skills.

Special extracurricular clubs (UK), Fermi problems (Germany), using a Freinet model that generates exploration based on children's free association (Belgium), links with companies (UK and Germany), maths clubs (Malta) and outdoor learning (Sweden) are all possible examples of enrichment opportunities.

Encouraging students to be open to and even **celebrate errors** (students in some schools we visited in the UK are given awards for the greatest mistakes of the week in order to build a culture of valuing learning from errors).

Many ways of moving away from an over-reliance on textbooks were observed or shared: good **hands-on practical lessons**, use of smart boards, online resources, group discussions, cross-curricular links, use of a story to explore maths concepts (Goldilocks and the Three Bears), etc.

**Professional development** is important for improving maths teaching. The UK schools receive support from local authority consultants as well as teachers who coordinate numeracy for each school. This promotes continuous, life-long learning. A similar model is in place in Malta through the establishment of a group of teachers to gather and share best practice in order to provide professional development. Individual schools have explored ways of providing space for dialogue among teachers (in Ireland, UK, Malta and other settings). Teachers have engaged with research through a journal club. They have discussed teaching approaches and methodologies, applied them and then finally returned to evaluate together. In some settings, such as Slovenia, new efforts to provide colleagues with the opportunity to observe one another are in place.

#### 2.4 ASSESSMENT OF THE TRANSFERABILITY OF POLICIES AND PRACTICES. COULD ANY EXAMPLES OF GOOD PRACTICE PRESENTED IN THIS REPORT BE APPLIED AND TRANSFERRED TO OTHER COUNTRIES? IF SO, WHY? IF NOT, WHY NOT?

Much of the ideas regarding cross-curricular teaching and applying maths to practical situations have universal application. Regarding resources, particularly ICT as well as models for small-group work led by teachers/teaching assistants, may be difficult to transfer as this would depend on allocation of funds. Finally, it is not clear what the long-term value might be of the clubs and special enrichment activities, especially if they are not universally open to all pupils.

### 3. Creating networks of experts, building partnerships for future projects is another important objective of the study visit programme.

Several ideas have been suggested to build lasting partnerships:

- Discussion on potential collaborative projects between participants (i.e. Bulgaria and Sweden on outdoor education).
- Continued use of the online blog created for the course to exchange ideas and engage in dialogue.
- Maintaining contacts and planning for future meetings , both at formal conferences and informal visits with other study visit partners.
- Development of new eTwinning collaborations (i.e. between Bulgaria and Malta).
- Use of school and organisation websites to maintain communication links.
- An on-going sharing of resources electronically.

## TO SUM UP

### 4. What is the most interesting/useful information that the group believes should be communicated to others? To whom, do you think, this information will be of most interest?

In summary, we feel the most useful information from the study visit can be summarised with the following points:

- A cross-curricular approach to maths is possible and beneficial through good planning and collaboration.
- Real-life situations or at least contextualised applications of maths skills are important at all age levels.
- A whole-school approach is very important, with also support and direction from the higher authorities.

This information will be of value to a variety of stakeholders in education including directors, colleagues, university students, teacher trainers, inspectors, local authorities and parents.