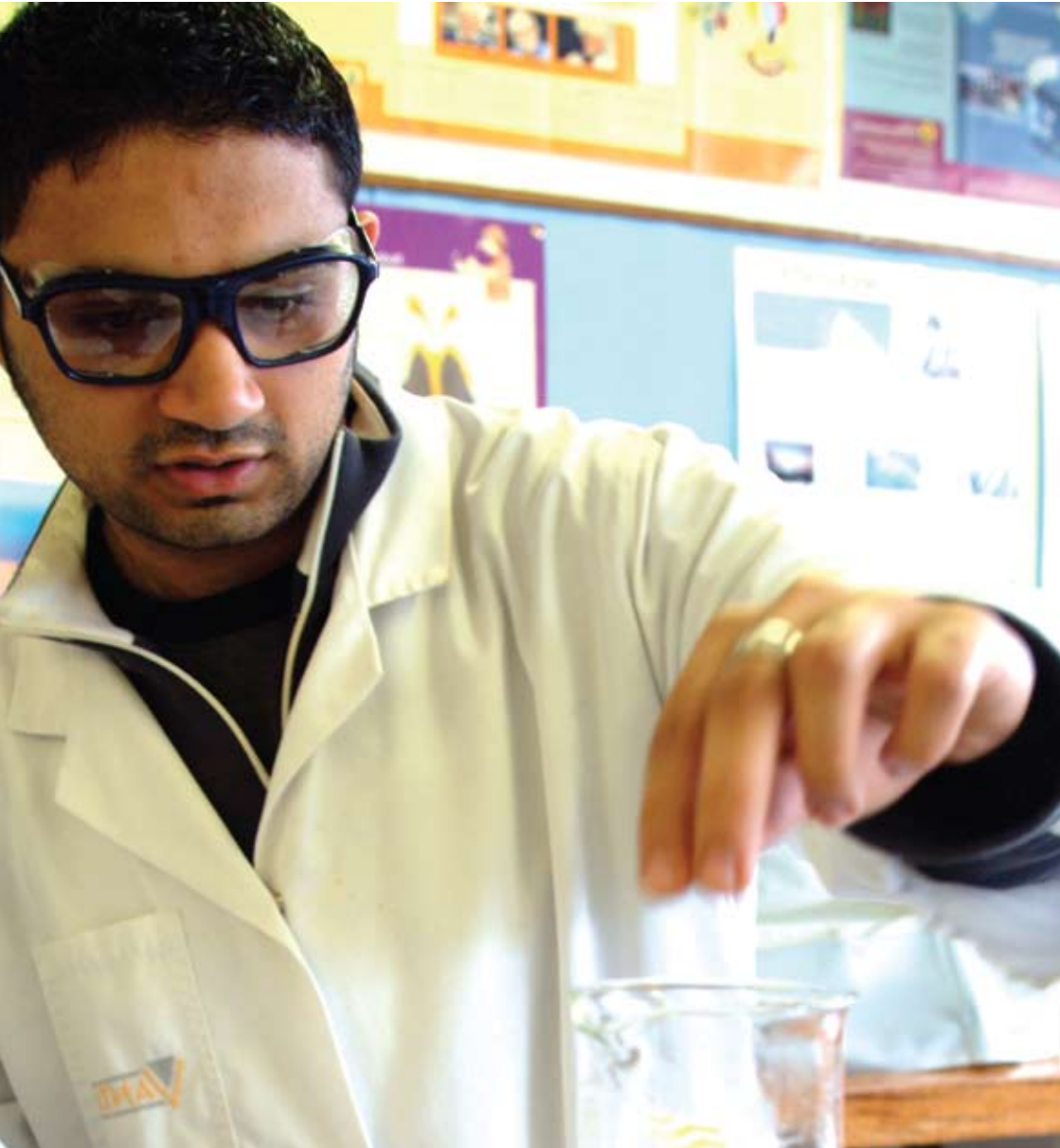


CPD into action: STEM

Science, Engineering and Mathematics



CPD into action: STEM Science, Engineering, Mathematics

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Foreword

I am delighted to introduce you to these new resources developed by the Quality Improvement Agency (QIA) as part of the Teaching and Learning Programme.

The Teaching and Learning Programme aims to support providers to improve the quality of teaching and learning by linking **organisational strategies** for quality improvement, **continuing professional development** (CPD) and the **Subject Learning Coach** model.

The focus of the Teaching and Learning Programme is on supporting **whole organisational approaches** to quality improvement with an emphasis on **helping the sector help itself**, knowledge transfer and building on what is already there.

Teachers, tutors and trainers in the further education (FE) system work with a very wide range of learners – in colleges, in work-based learning organisations, in adult learning, in prisons, in voluntary and community organisations and in the workplace. These resources have been developed in consultation with them and their learners as well as other subject and national experts.

These resources are designed to be used by those wishing to:

- explore more effective or different ways of teaching or planning learning in their subjects
- tackle ‘hard to teach’ or ‘hard to learn’ topics in their curriculum in new ways
- improve or extend their own professional practice
- construct dynamic action plans to meet the regulatory requirements for 30 hours (or pro rata) CPD.

In addition, I hope these resources will be used by:

- teacher educators working with teachers to gain initial teacher training qualifications
- Subject Learning Coaches working with their peers to improve teaching and learning
- curriculum, quality and Information and Learning Technology (ILT) managers working with their teams to improve practice.

I hope you will find these resources of real benefit to you and your organisation.

Markos Tiris

Programme Director, Teaching and Learning Programme, QIA

A continuing professional development resource

These continuing professional development resources focus on the three areas of Science, Engineering and Mathematics, prioritised by the government's Science, Technology, Engineering and Mathematics (STEM) agenda. They have been developed by QIA working in partnership with the National Science and Learning Centre (NSLC), the New Engineering Foundation (NEF) and the National Centre for Excellence in the Teaching of Mathematics (NCETM), as well as with subject specialists and education organisations from the three subject and vocational areas, and teachers* and learners. The resources provide a framework and tools to help teachers plan and develop their practice in ways that can be acknowledged and built on over time.

*We use 'teaching and learning' and 'teacher' as generic terms to include:

- teaching, training and learning
- teachers, tutors, trainers, lecturers and instructors in the further education (FE) system.

Science, Technology, Engineering and Mathematics

The STEM strategy aims to secure and sustain a supply of scientists, technologists, engineers and mathematicians.

The policies supporting the STEM agenda aim to deliver a step change in the effectiveness of the UK Science and innovation systems and establish the Department for Innovation, Universities and Skills (DIUS) as the lead government department responsible for supporting innovation in these subjects.

Education has an important role to play in making sure that there is an adequate supply of people with high level skills in the STEM subjects and that young people are scientifically literate citizens capable of using information and communication technology (ICT) and functional in Mathematics. To achieve skills at Level 3 and above, learners must have the relevant knowledge and experience on which to build.

QIA has introduced the STEM programme, as part of the Teaching and Learning Programme for post-16 education, to support quality improvement in teaching and learning by providing subject-specific support and CPD for individual subjects, Science, Engineering and Mathematics (ICT is already supported elsewhere within the programme).

These are brought together under the STEM umbrella and reflect the Teaching and Learning Programme's principles and methodology. The STEM programme includes teaching and learning resources, networks, a range of peer and community activities, and opportunities for professional updating.

The Teaching and Learning Programme promotes whole organisational approaches to quality improvement and offers support for leaders, managers and teacher educators. It also works with the Subject Learning Coaches (SLCs) programme to promote the Professional Training Programme for SLCs.

Finding out more about the STEM resources

The resources introduced here are modules of approximately 10 hours CPD for teachers of Science, Engineering or Mathematics.

What are the challenges?

Teachers today need to introduce learners to what it is like to work at the leading edge of Science, Engineering or Mathematics research and development. Learning in these areas must explore the social implications of techniques such as stem cell research, the development of new technology or the application of mathematical models, and relate them to the core disciplines of analysis, experimental techniques and the application of modern commercial Science, Engineering or Mathematics. Teachers will recognise that their role embraces these challenges and that these include planning learning around learners' starting points.

- Individual learners may well have very different needs and interests.
- Learners may have specific areas of scientific, engineering or mathematical understanding that they struggle with, and learning has to be planned around these individual needs.
- Some learners may not have the independent study skills required to enable them to get the most out of their learning programmes.
- Learners may find it hard to relate the disciplines they are learning to application in real life.
- Some learners need to be helped to engage in debate and discussion so that they can sound out their ideas and teachers can assess their understanding.

What are the aims of these resources?

These resources aim to stimulate debate about approaches used in teaching STEM subjects. They are intended to be used as stimulus material for CPD with groups of teachers and by those working on their own. They also provide sample activities that can be used with learners.

You will find the following themes running through the resources:

- confidence – developing teachers’ confidence in their own knowledge, understanding and skills
- collaboration – teachers from different subject areas working together to develop a more stimulating and effective learning experience for their learners
- challenging topics – taking a fresh look at topics that are underpinned by Science, Engineering and Mathematics and which learners find particularly challenging
- contextualisation – exploring approaches to help teachers and learners identify and articulate skills used within specific contexts.

CPD into action: Science

The CPD resource for Science has been developed with the National Science Learning Centre (NSLC). It provides resources that support teachers working alone or with colleagues to explore the constructive use of discussion in learning and to make effective links between curriculum Science and contemporary Science and its socio-economic developments. For example, these resources feature the use of scientific reasoning to evaluate the efficacy of biofuels and a case study of teachers who agreed to explore some of these ideas as part of their own professional development.

The resources will help teachers to develop and share practice that extends their own understanding of their subject alongside an exploration of the pedagogical issues that support effective practice.

The Science module can also be accessed from the NSLC website at www.nslc.org.uk.

CPD into action: Engineering



The New Engineering Foundation (NEF) has developed the self-study CPD resource in Engineering. Designed for teachers in the FE system, the programme builds on NEF's experience gained from many years of active involvement in supporting teachers to provide effective learning experiences for their learners, particularly in the area of industrial links and through industrial secondments.

For some years, NEF has been providing funding for teachers in post-16 education to take three week secondments in industry. Their experiences have informed the CPD module. Teachers will be able to reflect on the results achieved by others and follow guidance on how they can develop their own fruitful links with industry to update their skills and knowledge.

The resources can also be found at www.neweng.org.uk.

CPD into action: Mathematics



The focus of the Mathematics CPD resource, developed by the National Centre for Excellence in the Teaching of Mathematics (NCETM), is on supporting teachers in developing collaborative and interactive practice in the classroom. A key feature of the Mathematics resources is the reflective diary, based on the current requirements of the Institute for Learning, with prompts to encourage teachers to capture their thoughts, reflect on points throughout the material and plan their next steps. Teachers are encouraged to access the NCETM Personal Learning Space (PLS) to carry out the reflective activities, and the new CPD resource can be found at www.ncetm.org.uk.

Each of the new CPD resources includes:

- information about the benefits of CPD and the support infrastructure provided by the Institute for Learning, QIA's Teaching and Learning Programme, the NSLC and NCETM
- video clips with accompanying text and questions to provoke thought and aid reflection
- pedagogy approaches to support teaching and learning
- practical activities for teachers to use to help explore practice, examining and reflecting on their own approaches to teaching and learning and how to plan professional development
- case studies to aid reflection
- recommended web links
- CPD tools to aid reflection and recording of CPD planning, activity and personal development.

These resources model a CPD process that is aligned to the Institute for Learning's cycle of reflective practice and each can contribute the equivalent of around 10 hours towards the 30 hours (or pro rata) minimum requirement for CPD. They include downloadable tools to support the development of reflective practice and the process of recording, reviewing and informing practice.

You will be able to access the resources from QIA's Excellence Gateway (<http://excellence.qia.org.uk/>), as well as from relevant subject organisations, such as the NSLC portal for Science at www.nslc.org.uk, the NEF portal at www.neweng.org.uk for Engineering and the NCETM portal at www.ncetm.org.uk for Mathematics.

Further resources to support STEM subjects



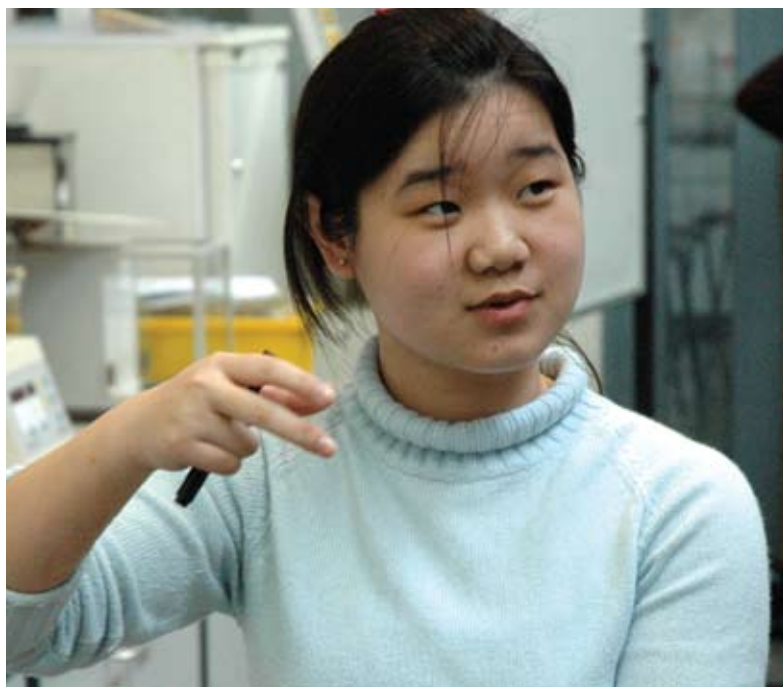
As well as the resources described here, you can find a wealth of teaching, learning and CPD ideas and activities in the new Teaching and Learning Programme resources released in Summer 2008: Improving teaching and learning in Engineering, Learning Mathematics in context and Improving teaching and learning in Science 2. There are additional resources relating to all three STEM areas on the Excellence Gateway.

All the resources will be available through QIA's Excellence Gateway at <http://excellence.qia.org.uk>.

How the resources can be used

These STEM resources contain materials that can be used as part of a CPD or SLC programme. The resources can be used flexibly, to suit the needs of a particular group of teachers. Many of the activities can also be used as starter activities to help stimulate debate and discussion.

We suggest you start by exploring your subject resource. You may also like to download the reflective activity, Small steps – big difference, from the web resources. You can use this activity yourself or with colleagues to reflect on the approaches that will most benefit your learners.



CPD into action

These resources are designed to help you get the most out of every professional development opportunity as you set out to develop your skills in teaching and supporting learning, and your subject-specific expertise. The reforms to initial teacher training and professional registration present you with opportunities for CPD and you will want to use these as creatively and usefully as possible. You can find out more about the requirements for professional registration from the Institute for Learning website at www.ifl.ac.uk.

CPD is not confined to formal training sessions. It includes making the most of a range of opportunities such as:

- collaborative working
- team teaching or peer observation
- industrial secondments
- industrial visits or updating
- membership of external networks
- online or remote activities.

Your professional development plan will also need to take into account wider organisational contexts, priorities and constraints, and might also reflect the development needs in your team. These priorities may not always be directly related to teaching and learning but they can often offer opportunities that help you match your professional development needs to the needs of your learners. For example, developing employer engagement strategies presents an opportunity to explore real world contexts for your teaching.

The model of support for CPD developed in the Teaching and Learning Programme resources aims to help you:

- reflect on your development needs and goals, and to create and implement a professional development plan
- explore and experiment with new ideas in your teaching, either individually or through collaboration with colleagues

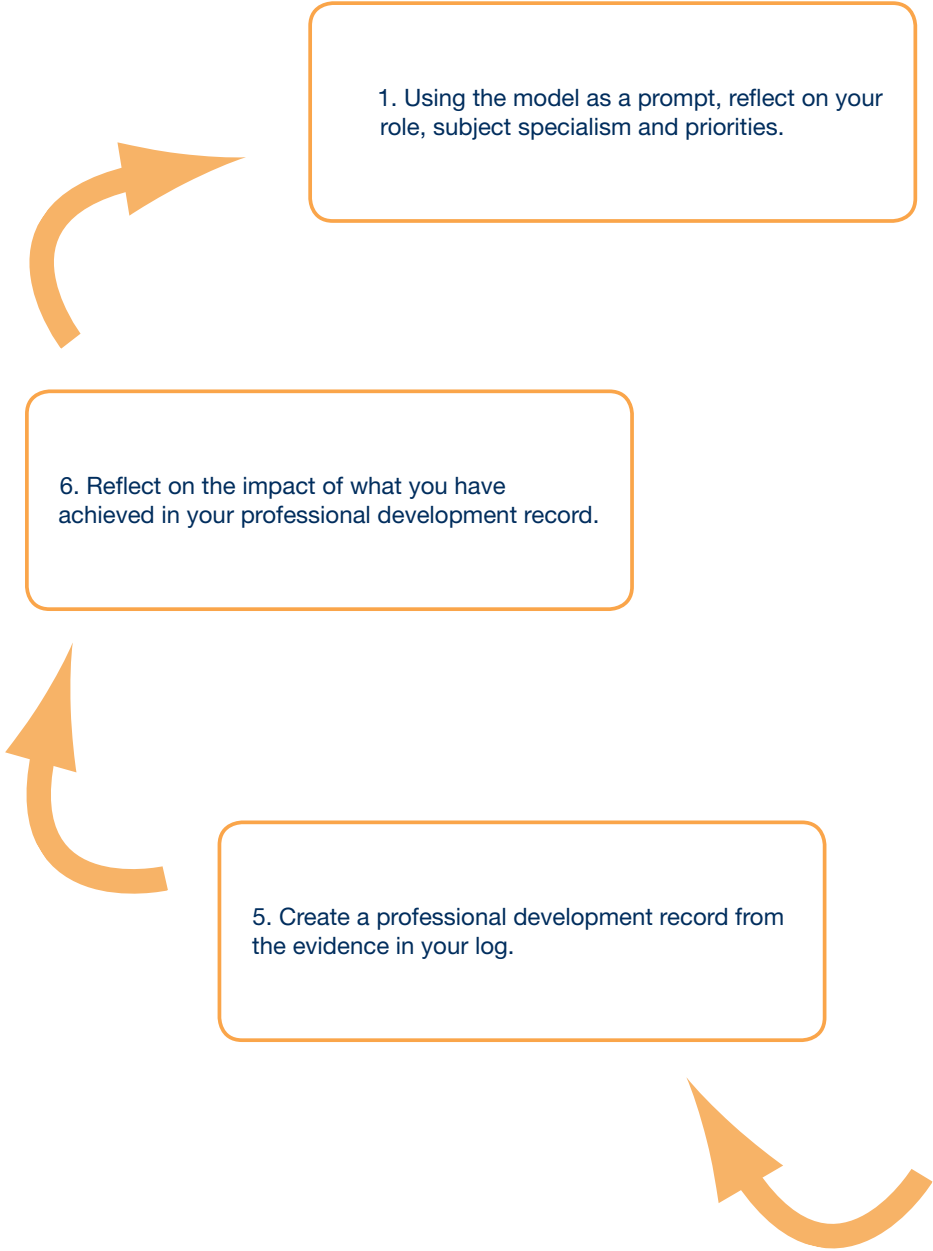
- evaluate and measure the impact of the outcomes – on your learners, on your own practice and on your organisation
- reflect on the impact of change on your practice – informally or through peer coaching to share, adapt and transfer effective practice.

This mirrors the Institute for Learning’s reflective practice model in Figure 1 overleaf, that sets out the professional development cycle for teachers, based on reflective practice. This is founded on the principle that CPD only results in long term change when teachers understand the theory behind effective practice, see examples of effective practice in action, experiment with new approaches and receive feedback on their performance. The Teaching and Learning Programme supports this principle through its SLC model.

Reflection is not always an easy skill to develop. The Teaching and Learning Programme advocates collaboration as a way to generate discussion, share new ideas about improvements in teaching and learning, and to stimulate reflection on the impact of these ideas on learners and on your practice. You can work through ideas or resources on your own, but you are likely to find it more enjoyable, challenging and productive if you seek the support and involvement of colleagues.

The CPD model is founded on a dual professionalism, meaning that teachers have a subject specialism as well as expertise in teaching and learning. Both parts of your professional practice are equally important, but the balance of the activities you undertake will inevitably be decided by a consideration of the context in which you work. You need to keep this relationship in mind as you reflect on your professional needs and goals and begin to plan your CPD.

The professional development cycle




1. Using the model as a prompt, reflect on your role, subject specialism and priorities.


6. Reflect on the impact of what you have achieved in your professional development record.

5. Create a professional development record from the evidence in your log.

CPD



2. Analyse your professional goals and needs using your reflections, reviews and appraisals.



3. Using this analysis, create a professional development plan for the coming year.



4. Carry out your planned activities and log outcomes and reflections on progress.

Recording your CPD

You will need to record your reflections, and the resources offer tools and processes to help you do that. Your organisation may have its own process for recognising and recording CPD and the log can form part of your CPD portfolio. Additionally, if you have access to a virtual learning environment, it may allow you to collect a greater range of evidence, including text, images, audio and video.

You will also find tools that enable you to record your reflections using a personal space at the Institute for Learning's website and at NCETM's website. You can use the tools to store reflections, discussions, comments and outcomes of your CPD. For details, see the Institute for Learning's website at www.ifl.ac.uk.

Conclusion

These resources will contribute to your professional development in Science, Engineering and Mathematics. They will help you to share effective practice and encourage discussion.

Please adapt, amend and add to them to suit your individual development needs.

This resource can be downloaded from the Excellence Gateway at <http://excellence.qia.org.uk>.

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