

How can evidence-based CPD programmes improve the professional development of science teachers?

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Evidence-Based Professional Development of Science Teachers in Two Countries

Developing accomplished teaching through CPD

This study explored the impact of science CPD programmes. The programmes were designed to help science teachers experiment and reflect on how they could develop and integrate new ideas they encountered into their classroom practice.

The specially designed CPD also involved teachers in collecting, analysing and reflecting on portfolios of evidence arising from their work in classrooms.

The researchers found that the CPD programmes in general and constructing the portfolios in particular provided opportunities for teacher reflection and learning. The CPD programmes were linked to marked effects on the teachers' practice, but initially the teachers found the approach difficult to implement.

This study will help teachers with an interest in CPD and in Science to explore some of the key ingredients and processes of effective CPD, including the importance of providing strong support in the initial phases.

Keywords:

Science, CPD, reflection, teacher learning

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What effect did the CPD programme have on classroom practice?

The CPD programmes were designed to do two things: increase teachers' knowledge of particular aspects of science teaching and to help them reflect on how they could develop the ideas themselves. The researchers found that the programmes helped teachers:

- familiarise themselves with new approaches and their underlying core principles;
- understand the implications for themselves and their learners;
- adopt and adapt the new approaches for their own context; and
- reflect on and modify their own beliefs with regards to teaching and learning.

The researchers commented that conventional methods of CPD are usually too short and infrequent to foster this kind of deep change in teacher classroom practice. By using materials that the researchers had already produced, and developing the processes that helped them reflect, the teachers were able to transform their classroom practice. For example, one teacher commented:

'This year, because of the CPD requirement to bring evidence of good practice, the concept of integrating skills and contents instruction has become clearer and sharper. At the end of the CPD this year, I feel a shift from a feeling of "right intentions but unsuccessful ways of execution" to a state in which I can define operational objectives for LSS [learning skills for science] instruction and clear ways to accomplish them.'

How did the CPD programmes enable teacher reflection and learning?

The researchers found that the two most successful elements of the CPD programmes were the focus on classroom evidence and teacher to teacher collaboration.

Asking teachers to recognise and collect evidence from their own classrooms reduced dependency on an expert coach. It also helped to foster a teacher learning community that provided support for the teachers in their learning. Being able to share difficulties and achievements with their peers provided the impetus for the teachers to take risks when they returned to their own classrooms. This was crucial to their professional growth. The researchers noted that, on the whole, the teachers felt positive and satisfied with the programmes, and as such:

- enhanced their acquaintance with particular domains of science teaching and learning, including ‘teaching scientific argument’ and ‘assessment for learning’;
- improved their pedagogical content knowledge;
- improved their practical teaching knowledge; and
- heightened their sensitivity to students’ understanding and progress.

The researchers found that the construction of portfolios as part of the programme provided further opportunity for reflection, discussion and learning for the teachers. The portfolios provided evidence of the progress teachers had made towards accomplished teaching in a particular aspect of science teaching, such as teaching scientific argument. They also enabled teachers to reflect more thoroughly and constructively on how they could further develop their strategies to support student learning, for example, one teacher remarked:

‘You were prepared to have a go at new ways of working, to reflect on what happened and refine it so that it worked everytime.’

What did the teachers find difficult about the evidence-based approach to CPD?

Teachers initially found the evidence-based approach to CPD difficult due to:

- time constraints;
- problems of acceptability of new approaches with colleagues in school; and
- problems of working new ideas into their existing practice, so that different overall practice emerged.

The teachers found that putting the ideas developed during the CPD sessions into practice when they returned to their classrooms challenging. It required a full understanding about why they were bringing in new practices. This involved examining and perhaps changing their views about what constituted effective science teaching. They also needed to justify to their students and other colleagues their reasons for changing practice. This highlighted the need for strong support from the CPD leaders throughout the entire process.

However, when they looked back on their experiences, many of the teachers recognised that the concerns they had had were not as critical as first envisaged:

‘The idea of having to bring evidence was scary but, in reality, it’s been the thing that has helped me see what I am doing and not doing to help my students learn.’

What did the CPD programmes entail?

The CPD programme involved activities designed to directly develop teachers’ skills in collecting, sharing and reflecting on practice. Some of the programmes offered new approaches for the teachers, while others built on existing practice, for example teachers on the *Classroom Assessment* programme found it helped them to concentrate on aspects of

science teaching that they were already familiar with, and look at how they might improve it.

The researchers offered evidence based programmes in six domains of science teaching. These were:

1. teaching scientific argument
2. teaching scientific enquiry
3. assessment for learning
4. teaching learning skills in science
5. teaching inquiry in the chemistry laboratory
6. teaching knowledge integration in learning physics

The six domains of science teaching illustrated some of the important qualities needed by an accomplished teacher of science. According to the researchers, to become an *accomplished* teacher means developing both knowledge of their subject matter and pedagogical content knowledge (concerned with the teaching and learning of a particular domain of science and understanding how students learn within that domain). It was important that the teachers understood what was meant by accomplished practice in a particular domain as it provided a sense of direction and helped the teachers focus their efforts.

The CPD programme was based on a process of:

- setting goals;
- learning from examples by reflection on the evidence from practice; and
- customising and developing ownership of the next steps towards accomplished teaching.

How did the portfolios contribute to the teachers' professional learning?

An essential part of each programme was the construction of an individualised portfolio (submitted towards the end of the programme). The portfolio was the impetus for teachers to collect evidence of the implementation and outcomes of teaching strategies, and to discuss and reflect on their developing practice. The researchers guided the teachers on how to construct their portfolios.

The evidence teachers added to the portfolios included resources they had developed, workplans, student outcomes, video material, observation schedules etc. The peer discussions around the portfolios meant teachers could analyse evidence together, and share and adapt ideas from each other.

Examples from the portfolios illustrate how they encouraged teacher reflection as a way of enhancing future practice. One teacher, for example, commented in their portfolio:

In this KIR activity, I asked questions, they answered, and I could not anticipate how it would evolve and whether I would have the answers. This was a tiring lesson, but it was "good" fatigue. It made me think about changing and expanding the teaching methods in my classroom.

Where did the evidence come from?

The research was carried out in two countries – the UK and Israel. The CPD programme aimed to promote ‘expert teaching’ – but the teachers preferred the term ‘accomplished’ to ‘expert’. An accomplished teacher was defined as a member of a professional community who is ready, willing and able to learn from his/her teaching experience. The main aim of the study was to design and test an evidence based CPD programme.

The research was carried out in three phases:

- the individual CPD programmes were piloted with 32 teachers who had expertise in the particular area
- the CPD programmes were trialled and evaluated by 38 experienced teachers who had only a small amount of knowledge of the specific area
- the CPD programmes were refined and trialled again by 34 teachers with minimal knowledge of the area.

In each programme, the teachers were involved in 30-40 hours of teacher meetings, typically divided into 6-10 whole or half day sessions over two terms with periods between teacher meetings utilised by the teachers to explore and develop ideas in their own classrooms.

Data were collected both by the teachers involved in the CPD programme and the researchers. Video or audio recordings were made of each CPD teacher meeting and data were also collected from interviews (which were transcribed), class observation, class videos (critical incidents were transcribed) and questionnaires. The completed portfolios also provided a rich data source.

What are the implications for teachers and leaders?

In completing this digest the authors began to ask the following questions about implications for practitioners:

- The teachers found it helpful to reflect on portfolios of evidence they had collected during their classroom enquiries. Is there an aspect of teaching, such as teaching scientific argument, which you would like to explore through collecting and reflecting on evidence, such as lesson plans and student work etc.
- Having opportunities to reflect helped the teachers to evolve new classroom practices. Could you find opportunities to work with a colleague in carrying out enquiries that involve experimenting with new ideas, and reflecting together on what you have learned and how you have developed your practice?

School leaders might like to consider some of the following implications:

- The teachers benefitted from the support they received from external specialists and peers. Could you help staff in your school to identify specialist support for their development, for example by putting them in touch with Advanced Skills Teachers (ASTs) or local authority advisors?
- The study showed the teachers needed strong support, particularly in the early phases of this CPD programme. One of the problems was time constraints when constructing their portfolios. What opportunities do you have to free teachers' time for this type of activity? Could you, for example, split inset days into a series of shorter development sessions that could sustain this kind of level over a series of 1 hour sessions?

Where can I find out more?

For more details about what the CPD programmes entailed and examples of evidence the teachers collected in their portfolios:

<http://cpdthroughpoe.com/index.html>

For a more detailed summary of research into the impact of collaborative CPD on teaching and learning, you might be interested in the following Research of the Month summary:

http://www.gtce.org.uk/teachers/rft/collab_cpd0204/

For more research into raising students' achievements in science, you might be interested in the following Research of the Month summary:

<http://www.gtce.org.uk/teachers/rft/science1204/>

For more research into the factors which help the professional growth of teachers and pupil learning, you might be interested in the following Research of the Month summary:

http://www.gtce.org.uk/teachers/rft/prof_learn1205/