Evaluation of professional development: deploying a process focused model

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Abstract

This evaluation used a change transition model to explore the processes of development of a three-phase professional programme devised by two teams of researchers to support teachers' expertise in six domains of science teaching. The full programme operated over two years. Interviews with developers at the end of each phase (21 interviews) and with teachers at the end of phases two and three (11 interviews) formed the main data set. The four features of the change transition model – trigger, vision, conversion, maintenance – were used as a framework for analysis of the qualitative data. Four themes emerged as contributing to the success of the process of development of the programme: establishing a shared vision of the goals of the programme and its outcomes; maintaining flexibility in implementing the phases and details of the programme; negotiating common understanding with participants; and ensuring fruitful collaboration in planning and implementation. The demands of attending to all of these features should not be underestimated in any successful developmental process. The evaluation thus provides evidence for additional guidance in future collaborative professional development.

Keywords: evaluation; change management; professional development

Introduction

King's College London (KCL) and the Weizmann Institute in Israel worked on a joint initiative, funded by Gatsby's Science Enhancement Programme (SEP), to improve the quality and effectiveness of continuing professional development (CPD) for science teachers. As reported in the other papers in this volume, they developed six domains of science teaching - argumentation, formative assessment, scientific enquiry, learning skills for science, knowledge integration and inquiry in chemistry. For each domain the following had to be co-constructed:

- theories and evidence of expertise in each area;
- a CPD programme to develop expertise in less accomplished teachers and document that growing expertise through portfolios of evidence.

The programme was developed in three phases, each offering opportunities for refinement, and the developers collected evidence of teachers' expertise and the outcomes.

This paper reports an independent evaluation of the process of development and implementation of the programme and deliberately does not overlap with any reflection developers themselves undertook in their evaluation of progress.

There is a substantial body of research into what makes CPD effective for teachers, which the developers of the project drew upon. Many studies have shown that its success increases when implemented over a long timescale and incorporating opportunities for reflection on any changes teachers make (e.g. Adey, 2004; Darling-Hammond & Youngs, 2002; Joyce & Showers, 1988). Loucks-Horsley, Hewson, Love and Stiles (1998) believe that, rather than one clearly preceding the other,

changing teachers' beliefs and changing their classroom practice is more of a cycle, where each reinforces and provides impetus for the other. Developers thus need to consider how to create, or co-construct, such cycles as part of a CPD process. To date, little has been written about the processes undergone in collaborative development of effective programmes. The research reported here was designed to contribute to understanding of the processes of CPD principally from a perspective of devising effective programmes as a management of change.

Conceptual basis of the evaluation

CPD is a broad concept used widely in organisations to denote those activities that increase employee performance and organisational output. It assumes that employees have basic entry skills obtained through some form of formal or informal training obtained prior to the employment contract. For example in education, most teachers enter the profession as newly qualified teachers after a period of initial teacher training. In order to move these teachers forward and prepare them for new challenges, it is assumed that teachers need new knowledge, skills and attitudinal dispositions to enhance their effectiveness and ability in adapting to change. The concept of change itself denotes a 'disruption of the status quo' (Paton & Southern, 1990; Schein, 1988). Individuals and organisations possess a natural tendency to maintain a steady state, so any changes that disrupt this status quo are viewed with caution and are only accepted if the perceived outcomes add value to the individuals and their organisations. Change thus has to be carefully managed.

An interesting view is to consider change as a series of transitions from one state to a more desired end state through a four layer model – trigger, vision, conversion, and

maintenance and renewal (Buchanan & McCalman, 1989). In the case of teachers, we could posit a linear model to describe the various stages of this transition from student teacher, newly-qualified teacher, novice teacher and - through natural experience and formal training in the work place - to competent teacher. Careful CPD interventions could be put in place to turn the competent teacher into an expert. Such a model is crude and does not adequately describe the nuances of professional development and the difficulties of identifying and defining competent and expert teachers (see Berliner, 1994). The boundaries between the transitional stages are not clear cut and it is difficult to map out a career and professional development path for teachers. This becomes a major challenge for those conceptualising the development of CPD in education.

Trigger layer: this layer concerns the need for change, in terms of opportunities, threats to the individuals and the organisation, the crises the organisation faces and its needs for the future. In communicating these triggers, emphasis must be laid on the opportunities for change created. Key questions include:

- What did the developers see as the trigger for the project?
- What triggered teachers' involvement?

Vision layer: this involves establishing the future development of the organisation by articulating a vision and communicating this effectively. The vision should address three key aspects: how the change addresses the triggers, identification of a desired future condition and the challenges and motivation for the intervention. The articulation of this vision is of paramount importance as future participation in the change depends on it. Issues guiding analysis are:

- What are the intentions of the development in terms of teachers' expertise?
- How does this development meet with the individual needs of the teachers?
- What challenges might be met in working with teachers and how can these be resolved?
- What strategies can be used to motivate people to sign up to these changes?

Conversion layer: this is an implementation phase involving persuading and converting people to commit to the vision. If people are not part of the whole idea, the project is likely to suffer 'tissue rejection' (Maringe, 1989). Key questions include:

- How much empathy exists between teachers' own aspirations and the project goals and processes?
- To what extent do teachers feel ownership of the project?
- How much shared understanding of the change exists between programme developers and the teachers?

Maintenance and renewal layer: this involves management of mid term change. A clear identification of mid term outcomes is needed as progress is made towards the final intended product. It also involves ensuring that desired changes are properly institutionalised so they become integral to the organisation. Questions suited to analysis at this level include:

- What strategies are designed to maintain the teachers at the level of experts once this has been attained?

- How will the programme evolve beyond the initial vision to reflect new conditions?

We adopted this change transition model as the framework for evaluating the development of this innovative CPD for two reasons. First, the change transition model places greater focus on the processes rather than the outcomes of an intervention. In determining the scope of this evaluation, we decided to focus on how the various transitions were managed and the extent to which strategies used contributed to the overall achievement of the project objectives. Thus measuring the quality of outcomes, such as portfolios, was clearly not a part of our evaluation remit.

Second, the model provides a rational framework for conceptualising and evaluating changes taking place across a variety of organisational layers of the project. We assume that purpose driven change of developing specific expertise in teachers represented a rational approach to CPD. Ultimately, we chose this evaluation model for reasons of simplicity, elegance and fitness for purpose.

The evaluation thus focused on the evolution of the programme as a process of management of change, and how modifications were made to the project through implementation. Its specific aims were to study:

- the effect of the three phase life-cycle of the programme on the developers' perceptions of the purposes of the programme and its processes;
- how the purposes of the programme were developed and translated into CPD experiences;

- to what extent the programme was perceived as successful in documenting and developing expertise.

Where appropriate, we followed or adapted Guskey's guidelines for improving the evaluation of professional development, for instance clarifying and assessing its goals, gathering and analysing evidence from participants (Guskey, 1998).

It was acknowledged at the outset that there might be differences across the six domains in terms of how developers conceptualised, initiated and developed the work in their domain. Rather than consider each domain separately, we looked at change management across the combined project. The main reason for this was to bring an over-arching perspective, distinct from that which featured in individual domains (see other papers in this volume for development in individual domains). There was an international collaborative dimension to the project in developers sharing perspectives on expertise and their methods of working with teachers that we felt important to explore in this evaluation.

Research Methods

Data collection consisted of semi-structured interviews with both the developers of, and the participants in, the programme. Documentary evidence (primarily proposals and reports to the sponsor) was also examined.

Developer interviews took place at three stages of the project: once after the first full trial of the programme, once after the second, and again after completion of the project. At least one developer from each domain was interviewed at each stage. The

UK developers were questioned face-to-face and the Israelis by telephone. In all, 21 interviews were completed.

Participant teachers from the UK part of the project were also interviewed, either face-to-face or by telephone. Six teachers from the second phase of the project (two from each of the domains run by the UK university) and five from the third phase were interviewed on completion of their formal sessions.

The developer interviews were designed to gather reflections on the different stages of the project and to explore how aims, expectations and experiences changed over time. Areas probed included perceptions of the goals of the project, how expertise in the area was conceptualised, the difficulties in developing the programme, and the extent to which one phase informed the next in an evolutionary process. The teacher interviews were complementary to these, covering issues such as their reasons for engaging in the programme, their perception of its aims, how involved they felt, how it had influenced their everyday teaching and their identification of the programme's strengths and weaknesses. Thus, the interviews gathered evidence for the change process as conceptualised using Buchanan and McCalman's four layers.

All interviews were transcribed. These were analysed using a grounded-theory approach (Strauss & Corbin, 1994) in which transcripts were scrutinised iteratively and reflexively for major emerging themes, in relation to the four elements of the model – trigger, vision, conversion, maintenance. A qualitative data analysis package, NVivo, helped with the mechanics of coding the transcribed interviews and facilitated comparison between teachers and developers as well as different phases of the

project. Sections of interview were coded according to one or more of the four elements and additionally the interviewee's main focus identified from the content of the utterance. In order to validate coding, each of three researchers independently coded an interview transcript. This initial coding resulted in minor differences between the use of trigger and vision codes and consensus on the theme, such as 'expertise' 'inter-domain collaboration', embodied in the utterance. Discussion and coding of further contentious sections resulted in 80% agreement in use of common codes across all transcripts. Anonymised transcripts were used throughout: pseudonyms for teachers, numbers and prefixes for developers (I for Israeli developers, U for UK developers).

Results and Analysis

We present findings in relation to the layers of the model, focussing mostly on trigger, vision and conversion. Issues around maintenance and renewal featured rarely in the data.

Nature of triggers

For developers, the triggers related to why the CPD programme itself was necessary and why they personally got involved. Typical examples were:

> I4: I have been working on [domain] for the last 25 years and I consider myself an expert in this area and I believe in it very strongly. I also believe that we can really help teachers to change the practice in ways that makes the learning much more meaningful in terms of [domain].

> U3: It (the project) links very closely with various work we have been doing about CPD and about descriptions of an accomplished teacher in various areas.

Developers thus argued their involvement from a position of recognising the contribution they could make to development of expert teachers in a given domain and their experience in leading professional development.

In contrast, and perhaps unsurprisingly, all the teachers interviewed were motivated primarily by a desire for self-development - improving their skills, picking up new ideas and gaining an opportunity to reflect on their practice – but not necessarily becoming an expert. In some cases, they wanted to make the domain more useful and applicable to students, consequently raising performance:

> Parvati: … what were we doing wrong really … but it's getting the kids there that I felt we really should develop a bit more.

The teachers had different levels of familiarity with, and therefore accomplishment in, the domains. Some were stimulated by a specific interest in the area, either because they were already engaged with it, or were aware of it and wanted to realise its potential:

> Bina: I've been interested in (domain) for a long time. …..we've implemented quite a few things that the research shows are useful.

There was widespread recognition that the focus of science teaching was changing, leading to a demand for new skills. Some teachers referred to weaknesses within their

departments that needed addressing. Career progression as such was only rarely voiced as a reason for participation in the project. Bina's views succinctly summarise those expressed:

> Bina: My aims for joining the project … wasn't to promote my career, it was really to promote my teaching … to make sure that my teaching was effective and that pupils gained as much as they could from my teaching and the department as a result as well.

According to the Buchanan and McCalman model, the triggers to participation interlock with and impinge on the vision. Thus, triggers not only incentivise involvement but also help determine an individual's expectation of the outcome of change. The strength of the triggers can relate to the commitment to change, and if people are motivated by different triggers this needs to be recognised as it might affect the development of a shared vision.

Nature of Vision

Since the collaborating teachers joined the project for rather different reasons from those driving the developers, some tensions arose as a result of goal incongruence. It is to be expected that developers and teachers may have different goals while sharing a common vision of enhancing professional development. However, it is perhaps surprising that the goals of developers across different domains did not always coincide.

The teachers tended to see the main goal of the programme as developing their teaching in the domain and therefore enhancing pupils' learning:

> Parvati: … to try out things, to aim to improve ourselves … to actually try and identify what would be a good teacher [of domain] and then find out where we were and then working towards sort of improvements.

In contrast, developers shared the same central goal of developing CPD for teachers. However, individuals emphasised different aspects of it – defining expertise/accomplishment in that domain, its long-term nature, the focus on classroom practice and student learning, the role of evidence, the production of a tool kit/tools and procedures, and its eventual use by other providers (e.g. heads of science departments):

> I3: We are talking about evidence-based professional development of … teachers. In which bringing the evidence is one of the most important means to achieve their professional development.

> U2: … to develop a continuing professional development programme, to be used by other people like other science education sort of trainers, educators, and heads of departments.

> I4: The main goal is to find or design a framework for long term professional development of teachers.

> U3: …helping support teachers in their CPD or in their development towards accomplished teaching.

Other goals (including producing research papers, building a nucleus of expert teachers and the cross-cultural dimension) were only mentioned by single developers.

Developers were focused on defining and evidencing expertise (primarily through the portfolio) whereas teachers were looking for classroom activities and improvements. In more than half the initial interviews, developers mentioned the goal of collecting evidence into a portfolio. It did not feature at all as a goal for the teachers, although they showed some retrospective appreciation of it as a concern for the developers. Only a few teachers explicitly recognised the developers' goal of providing guidance for other teachers in the future.

The teachers' emphasis on practical applications was underlined when they were asked to discuss the strengths and weaknesses of the project. Resources had either represented a major plus point (being given materials to use in their lessons), or represented a serious difficulty when absent (struggling to produce tasks that would meet the objectives they had been set by the developers, e.g. Amit: 'I don't know if there are that many fresh ideas'). They were also keen to increase their knowledge of the domain as exemplified by George:

> To understand that there is more than one type of investigation that counts as investigation work … the skills required, that they can be taught and it's right to teach them.

Teachers were generally satisfied with the way developers had communicated the goals to them and just one felt there had been a lack of clarity at the outset. However, the initial lack of shared vision across developers and teachers may reflect the different triggers for engagement. Establishing a shared vision or clarifying intentions through sharing and revisiting goals may help developers and teachers in understanding the potential of the programme as it unfolds and modifies. The iterative

nature of trigger, vision and conversion became more apparent as the programme developed.

From vision into practice

Several issues emerged in the process of converting the vision into constructive development of the programme. The most fundamental change, referred to by some but not all of the developers, was a perceived shift from the goal of demonstrating accomplished teaching to that of achieving teacher change – i.e. improvement but not necessarily accomplishment, exemplified thus:

> I5: Now we are aware that accomplishment is very difficult to attain, but at least the goal was to see whether they changed from the beginning to the end of the project.

Most of the developers referred to the necessity for practical adjustments in the way the vision was realised. Time limitations meant the original plan for teachers in phase three to become expert in additional domains was not feasible. Problems recruiting and retaining teachers proved a major impetus for many of the other adaptations. The length of the programme, stretching over many weeks, was recognised as a strength in terms of effectiveness but a difficulty when it came to the everyday realities of fitting it into busy lives or securing time away from school. Competing pressures on teachers helped dictate what was possible:

> I3: I mean they have no time. They can't afford to waste their time, and we had to be sure that in every meeting there will be something very useful for them which they take immediately to their class and use it there. And something which they consider to be very important for their

> practice, otherwise why bother … We couldn't you know have the luxury of talking and thinking together.

Where there was low turnout, teachers such as Fran identified it as one of the few weaknesses of the project: 'It would have been nicer to have more teachers to bounce ideas off'. Some of the difficulties of conversion have lessons for maintenance and renewal. Consideration needs to be given to strategies which maximise the participation of busy teachers. Creative solutions, including timing of sessions and 'virtual' support were identified by developers. Referring to the Buchanan and McCalman model, it could also be suggested that the commitment of teachers who dropped out was weakened by a lack of sharing and clarity in terms of trigger and vision. Because only completing teachers were interviewed, this can only be hypothesised. Reasons given by developers for teacher dropout included school pressure, illness and lack of response to communications.

The long timescale and iterative nature of the programme allowed developers to experiment with organisational aspects of the course such as the amount of theory included and the order in which it was introduced:

> U1: Re-evaluating where to introduce the theoretical underpinning of the nature of [domain] was quite an important thing … whilst we went through phase two.

Use of portfolios

The area requiring most rethinking in terms of vision and conversion across the domains was compilation of the portfolio of evidence. We use this example of development of portfolios to highlight issues that can occur in innovative and

complex projects. Identifying, collecting and compiling evidence of accomplished practice were key parts of the project and proved unexpectedly problematic. Developers found conceptualisation of the portfolio less straightforward than anticipated in terms of its purpose, how it should be introduced to participants and what should be included as evidence.

There is a growing body of literature about the best use of portfolios within teacher development (e.g. Beck, Livne & Bear, 2005; Klenowski, Askew & Carnell, 2006; Orland-Barak, 2005). One of the issues is the conflict between using them for development or for assessment. At the beginning of this project, the developers did not have a clear or shared conceptualisation of the portfolio's purpose. They stressed different aspects of its role, including using it to demonstrate that improvement was taking place; showing the effect on pupils' learning; and, for one developer, acting as a substitute for in-school support. There seemed to be a sea change from certificating the attainment of a certain standard to being a formative tool, or from existing simply as an output to being regarded as a process of developing skills and reflecting on progress. Although views tended to converge, particularly after a mid-project conference involving all the developers, it was acknowledged that there remained some differences between domains:

> U2: It became clear … that what we wanted to do was use the portfolio to support the process of teacher change rather than to be evidence of a particular standard. So that's a significant change. But one or two people still seem to hark back to the idea of the standards. Although I think the consensus is that that's not what we're doing.

> U1: All of us … had quite different ideas about what a portfolio should look like. So I think the difficulties come when there are different perceptions about what different things are for, like what the portfolio is for … and that's not unhealthy.

The mismatch in goals between developers and teachers undoubtedly contributed to some of the problems experienced over the compilation of the portfolio.

The teachers had various views about its purpose, but two predominated. Firstly, there was the notion of the portfolio as an instrument for developers, to help the evolution of the CPD programme. This included using ideas from the portfolio to train other teachers, to develop materials and use in teaching, and to see how strategies are executed in class. It could also act as evidence for other teachers in the programme, showing them what has been achieved and via what activities:

> Kate: To show the next phase … what sort of activities we'd used, so like a reference point for them, and also for anybody who's not been able to attend these sessions to see how these targets can be achieved.

The second key function of the portfolio, about which the teachers were much more positive, was as a reflective tool. It helped them think more carefully about what they were doing – what had happened in the lessons compared with what they had hoped for. Some found it useful to show what progress they had made, and there was interest from those who were heads of department in adopting it as a tool to use in developing their staff. Only one teacher (Meena) saw it principally as demonstrating attainment.

> George: I don't know whether the main purpose of it is for me to put something together or whether it's to get something which [developer] would then use, or whether it had both

> purposes, so it's a good thing for me to do, because it helps me actually think about my teaching, makes me think about what I teach more.

> Meena: The whole point I think of the portfolio was just to kind of provide the evidence to show that you were capable, or you were able to meet the standards of the good practitioner of [domain].

Goal mismatch also meant that developers could struggle to justify the portfolio to teachers and there was considerable resistance to spending time compiling it:

> Jane: I don't know exactly what our portfolios will be used for, and it is possible that us writing a portfolio was just their way of getting us to do the work, and … it would be really irritating if all those hours I spent writing it up wasn't actually for any purpose.

Developers were surprised by the extent to which teachers struggled to extract good evidence of accomplishment from their classroom practice and present it in a meaningful way:

> I1: What was difficult is that we really didn't know what is a good evidence. And even if we knew we were surprised and really astonished to find out that the teachers really don't have any experience of how to give evidence … They don't know how to draw conclusions and all this was very very new to them, they did everything very intuitively … And we, not knowing that they don't know it, we had to develop the strategies on how to work with this. So it was not easy for us at the beginning and not for them.

In all six domains, the process of gathering evidence and constructing portfolios had grown easier by the third phase. Partly, this was because the developers had a clearer

idea of what they wanted, but also they made changes to how and when the concept of the portfolio was introduced, its structure, and the amount of support given.

The specific solutions varied by domain, sometimes in a contradictory fashion. As regards timing, in one domain the portfolio was originally introduced late on in the workshops but became integrated with the subject of the domain from the beginning. Elsewhere, although teachers were encouraged to collect evidence from the start of their involvement, the concept of creating portfolios was left until a session nearer the end. Some developers reduced the emphasis on the portfolio as an output to make it less daunting for teachers.

Developers were divided about whether the portfolio should be structured and systematic or more flexible:

> U2: I'd like actually to give them a folder and within it it would be sub-divided into different sections, and at the beginning of each section it would have the date by which that should be completed and it would have the number of words that you're meant to do and so on.

> U3: … it is OK to actually allow even inexperienced teachers to decide on what they are going to put into their portfolio. All the way through the project there has been a debate about should we actually demarcate what they do produce for it … but in actual fact in terms of their development … I think the sort of openness of it did work.

There was a move towards giving teachers more support and scaffolding to achieve successful completion, accompanied in some cases by a greater emphasis on teachers collating evidence in the face-to-face sessions rather than compiling portfolios at home:

> I2: Almost at the end of the 2nd phase we realised that we had to devote the last meetings in order to elaborate on the portfolios … we understood that on the 3rd phase we shouldn't put such a burden on the teachers' shoulders at home. And we should do more work here in the institution during the meetings.

Although the developers were more satisfied with the portfolios compiled in phase three, many of the participants still found it a time-consuming task:

> Fran: [The portfolio was] a nightmare to be honest with you. Mainly from the point of view that it was a priority in my life in that I was committed to it, but it wasn't a priority in my teaching life.

To some extent, it seems the nature of the solutions was less important than the developers' improved awareness of teachers' expectations and capabilities, leading to greater confidence in introducing the portfolio, alongside the emerging clarity about its purpose.

We consider that the views and actions of the developers and teachers show the fundamental importance of maintaining flexibility in the development process, and the necessity of constantly re-examining triggers and vision to ensure that any adaptations are in line with the desired overall trajectory of the programme.

Documenting expertise

Defining and documenting expertise was key to the original goals of the project, but proved problematic. The teachers tended to resist the label 'expert', reluctant to be seen as models open to challenge.

> U3: I also think they were worried about being questioned about whether they really were expert.

They preferred to use the terms 'good', 'effective' or 'accomplished':

> Parvati: …try and identify what would be a good teacher of (domain) and then find out where we were and then working towards sort of improvements.

> Bina: It's when you said the word expert I wasn't sure ……but if we're looking at characteristics of a teacher who uses (domain), there are characteristics…I'd be able to identify a teacher who believes in (domain).

Developers reported that teachers did not always concentrate, as intended, on teaching skills and strategies when asked to define what represented an accomplishment in their domain. There was a tendency instead to focus on pupil ability or on what classroom activities could be used. In Israel, the leading teachers of phase one brought or cited examples of accomplishment that did not, in the developers' view, qualify as such.

When the teachers were interviewed about expertise, to some extent the emphasis on pupil ability remained. However, definitions seemed to have been enriched through discussion and exemplification. Some responses were domain-specific (such as the

benefit of traffic lighting in assessment for learning). Others were more general, such as acquiring insight into pupils' understanding and learning, and encouraging them to be questioning, independent thinkers:

> Dan: I think it has got a value outside science as well. Because it is just the way in which you get people to express themselves. They become much more confident in speaking.

Most teachers felt they had expanded, rather than radically revised, their understanding of the domain by the end of the process. Jane, for instance, said that before the CPD she would just have described the activities used rather than talking about increasing her awareness of pupils' abilities. But there were cases where the change was more fundamental, for example realising that scientific inquiry consisted of more than simply fair testing.

The discussion of the construction of portfolios and documentation of expertise shows how the extent of developing common understanding amongst project participants - at different levels of the developer/'expert' teacher/teacher quasi-hierarchy and at the same level - featured strongly as a theme in the development. Within the Buchanan and McCalman model, the negotiation and repair of a shared understanding involves re-visiting, re-evaluating and reforming at all four layers. So participants tested their views, against others, on the processes of bringing about change.

Collaboration

Co-operation and co-working formed an important part of this project on several levels: among developers (across six domains and two countries), among teachers and between developers and teachers.

Using teachers as co-developers is something that has to be approached with care. The developers had shifting attitudes about how much teachers should/could be involved in terms of decision-making. The extract below shows a developer softening in one area but taking a stand in another.

> U2: I think it worked well having the first phase defining what an expert teacher was and trying to collect evidence to show that. I think that was valuable. We were also meant to be getting the teachers to help us design a CPD programme. I don't think that was helpful. They don't know how to do that.

There were advantages in working with the 'expert' teachers in phase one – they were known to the developers from previous work so therefore were easier to recruit and mutual confidence had already been established. Compared to those in later stages, they were more homogenous in terms of what they knew. However, some of these phase one teachers had a particular problem with the portfolio, which perhaps made them less than congenial subjects for developing a prototype - because they already had the skills, cataloguing evidence in this manner seemed to them an irrelevance:

> I3: The idea of bringing evidence from class to start it with expert teachers was a real difficulty for us because these expert teachers … they already know everything. There is nothing new to learn, so why bother? … So we really had to struggle with them at the beginning, so in terms of bringing evidence, it was not good.

The involvement of practising teachers proved essential to the success of the development. It helped prevent weaknesses that might otherwise feature in CPD programmes put together by 'experts' remote from everyday teaching, who lack

contemporary experience in the school environment. Theorising this, using Buchanan and McCalman's model, we have to look at the way interactions between participants at different levels of the quasi-hierarchy moved the project forwards. The collaboration with the teachers, as expert or on becoming more expert, can be seen to be essential.

Collegiality was important to the process. For the teachers, this took several forms: relationships with the other teachers, with the developers, and within their schools. For the most part, sharing within the workshops proved an invigorating and fruitful experience. In some domains, virtual communities were established to enable communication outside the workshops (although not all teachers participated as much as hoped), and others had set up something on a more informal basis. Where such a support mechanism did not exist, it was an improvement spontaneously suggested by participants as a way of overcoming isolation between sessions. Lack of support from the school and senior management, and the pressure of implementing existing schemes of work, were obstacles to trying new ideas or even attending the workshops.

Cooperation between developers necessitated working across domains and institutions, in this case between two countries with different first languages and over 2000 miles apart. It should be noted that the project did not start at the same time in both countries, and this had implications for the degree of collaboration achieved.

The synergistic potential was demonstrated by collaborative working on common problems, such as teachers' difficulties turning artefacts into evidence for the portfolio. It created a wider pool of expertise and perspectives. However, whilst the

periodic face-to-face seminars were much appreciated, there was general agreement that lower-level communication could have been more frequent to help maintain continuity. When planned and structured, the cross-country alliance did not seem to have been given the same significance as the relationship between developers and teachers, and there was general recognition that it had not been exploited to its fullest extent.

We have already recognised that the change process is one of constant flux and continual revision, making close collaboration vital to ensure that participants are buying into a clear, shared vision throughout the course of the development. Such fruitful collaboration must be effectively managed and planned for because if left to itself, it tends not to happen.

Conclusions and Implications

The process of CPD development examined in this paper highlights the importance of a cyclical rather than sequential application of the Buchanan and McCalman model which was underplayed in their original conception of the theory. Participants in successful change have to continually revisit the triggers, re-evaluate the vision, re-direct its conversion into reality, and re-negotiate how the change can be effectively maintained and renewed. Four themes of importance to developing CPD have emerged from this evaluation:

- establishing a shared vision of goals and outcomes: not to be rigidly determined early on and never revisited, but something that benefits from regular re-examination;

- maintaining flexibility in implementation: not an optional extra, but a pre-requisite in the cyclical process of re-negotiation of the expectations of the development;
- negotiating common understanding between participants: a constant necessity at each of the four layers, i.e. why are we doing this?, where are we going?, how do we get there?, how do we stay there?;
- ensuring fruitful collaboration in planning and implementation: making certain that the processes of communication of goals, progress and outcomes are continually revisited by all participants, regardless of level of involvement i.e. in this case, whether they were developers, expert teachers or 'novices'.

Every developer found the iterative three-phase model invaluable, enabling progress from initial fluidity to a final refined structure. The extended timeframe and repeated trialling allowed for the evolution of thinking, for instance around the difficult issues of defining expertise, deciding how best to scaffold and support participants, particularly in collecting evidence, and clarifying the purpose of the portfolio.

This project highlights the demanding nature of designing CPD and shows that there are no shortcuts to developing successful programmes. Developers need to be willing to continually re-visit the layers of trigger, vision, conversion and eventually maintenance and renewal to construct programmes which fully engage teachers and contribute substantially to their development.

I5: 40 years in Science Education … and I can say easily that this is the most difficult project, the most interesting project, that I was involved in.

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