



**Training Teachers to Use New Technologies Impacts Multiple Ecologies:
Evidence from a National Initiative**

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Introduction

Abstract

A pair of papers re-examined the evidence from a national initiative to train all teachers in England to bring them up to the level of newly qualified teachers, who are required to know when to use and when not to use ICT in their professional practice. The first paper confirmed that Guskey's (2002) multi-level evaluation of professional development was robust for ICT teacher training (Author1, Author2 & Author3, accepted). This second paper contrasts the highest and lowest rated designs for ICT teacher training: an 'organic' approach that provided training in schools was highly rated, whereas a centralized computer-assisted learning approach with online access to trainers was low rated. The study supports an ecological view of the diffusion of ICT innovations in education (Author1, 2008, in press), and recommends that ICT teacher training be designed to support evolution of each teacher's classroom and school, as well as the training of ICT teacher trainers.

Keywords

Teacher training; IT-use; Distance learning; Continuing Professional Development; Computer-assisted learning; Organisational change.

Teachers' use of information and communication technologies (ICT) has an important role in education in the twenty-first century (UNESCO, 2007; Hinojosa, 2008, in press). Realising this, many countries and regions are designing ICT-related teacher training, including Africa (Evoh, 2007). Research has established that effective ICT teacher training is an important pillar for successful integration and sustainability of ICT in education (Culp, Honey & Mandinach, 2003; Haydon & Barton, 2007; Somekh, 2008, in press). Therefore research to inform the design of effective ICT teacher training is urgent, and given the demand, it is important to know how provision may be scaled up, possibly mobilizing computer-assisted training and distance learning.

An international literature review identified few studies on the characteristics of ICT teacher training (Author1 & Thompson, 2005; Author1, 2008, in press). The characteristics included in current designs are based largely on expert opinion with some support from case study research and survey data. Effective characteristics identified in the literature are: a direct relationship with each teacher's discipline and pedagogy (AACTE, 2008, in press; Condie, Munroe, Muir and Collins, 2005); with belief systems (Pickering, Daly, & Pachler, 2007); active learning by teachers developing their own professionalism over extended duration and participation of teachers from the same community of practice (Loucks-Horsley & Bybee, 2000; Author3 & Thompson, 2006); coherence with policy and standards (Somekh, 2008, in press); and leadership support and organizational change (Yee, 2001; Tong & Trinidad, 2005; Author3 & Thompson, 2006; Condie & Munroe, 2007). A well respected multilevel framework to evaluate teacher professional development in general was provided by Guskey (2002). Guskey laid out five critical levels for the evaluation of professional development in general: (1) participants' reactions, (2) participants' learning, (3) organizational support and change, (4) participants' use of new knowledge and skills and (5) students' learning outcomes. Author1, Author2 and Author3 (accepted) confirm that this multilevel evaluation framework also applied to ICT teacher training.

Pickering, Daly and Pachler (2007) advocate three themes in the design of continuing professional development (CPD) for teachers' adoption of ICT: collaborative learning networks, shared practice and scholarly reflection. They also emphasise the need for ICT CPD to acknowledge each teacher's belief systems and the potential conflicts for

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3 teachers whose practice is located within existing traditional frameworks. Most recently,
4 Author2 and Cuthell's (2007) study of the opinions of leading ICT advisers in the U.K.
5 about good design of CPD for ICT, found that they recommended the development of
6 communities of practice along with the creation of knowledge bases, practice-based
7 research, and multimodal accreditation designed to value the affordances of ICT in
8 teaching and learning.
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14 An ecological perspective brings together these disparate characteristics of ICT
15 teacher training (Author1, 2008, in press). It recognizes that teachers are the 'keystone
16 species' in the 'global biosphere' of education because teachers create the space for
17 learning and assessment within the potential chaos of each classroom and school. It also
18 recognizes that each teacher must change the ecosystem in his or her classroom in order
19 to adopt ICT within his or her pedagogy. Ecological forces select behaviours that
20 optimize each teacher's inclusive fitness within his or her ecologies. The adoption of ICT
21 disrupts curriculum and educational practices in the classroom ecosystem, so this
22 ecosystem must evolve to include ICT. Therefore, interconnected ecosystems must also
23 evolve to incorporate ICT, especially those closest to each the teacher. This theory
24 suggests that during ICT teacher training the ecosystem supporting effective ICT teacher
25 trainers must interact closely with each teacher in his or her school ecosystem. Author1
26 (2008, in press) reviews related research, including Zhao and Frank's (2003) ecological
27 analysis of a contained set of US schools that adopted ICT and calls for more research
28 including re-analysis of relevant data sets.
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41 A national initiative in England from 1999 to 2003, stimulated a range of
42 approaches to ICT teacher training within a common evaluation framework providing an
43 opportunity to study different approaches of ICT teacher training within the same
44 population of teachers and to test this ecological theory. This initiative was known as
45 NOF (New Opportunities Funding) after its source of charitable funding. As described by
46 Author2 (2004), 47 approaches to training provision were authorized and all providers
47 improved their approaches following several rounds of evaluation. The main objective of
48 the present analysis is to inform the design of ICT-related teacher training through the
49 contrast of two teacher training designs in order to examine the application of ecological
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theory to ICT teacher training, including the scaling up of provision to train large numbers of teachers.

Methodology

The Teacher Training Agency (TTA) was responsible for quality assurance of this national initiative in ICT teacher training in England. The TTA undertook this in two ways: quality assurance evaluation by ICT teacher training experts and surveys of a nationally representative sample of teachers in training. Author1, Author2 & Author3 (accepted) describe the data set for this opportunity sample covering 11 of the 47 different providers of ICT teacher training in England for whom quality assurance reports were accessible and for whom there were at least 15 survey responses and also confirm that Guskey's (2002) multilevel evaluation framework is applicable to ICT teacher training. This paper uses part of the same data set and digs deeper into the data for the two approaches that were evaluated as the most effective and least effective. Table 1 provides an overview of the 13 ICT teacher training approaches analyzed, including the extremes contrasted in this paper labelled A and M.

[Insert Table 1 about here]

The further analysis of this data followed the methodology outlined by Stake (1995) wherein all available data for the two approaches was used and comparisons made with the entire data set of the contrasted approach. Both A and M had 15 surveys each and the reports provided to the TTA by ICT experts. Approach A had two reports, with the second confirming that the design had remained effective with increased number of teachers in training. In contrast, M had five reports that signalled improvement of this training design over time.

This further analysis naturally fell into stages that were performed on each approach separately: (1) extract and confirm a description of the approach and its evaluation across Guskey's (2002) five levels; (2) identify processes for training the ICT trainers; and (3) analyze and contrast the engagement of two approaches within three interrelated ecosystems: the teacher's classroom, the school, and the ecosystem involved in the training of ICT trainers.

The context

First it is important to set the scene for these two case studies of ICT-related teacher training in England in 2000-2003. Following their evaluation in 2003, the MirandaNet Fellowship reported:

... [The English government's] bold step [was] to use innovative teaching methods like e-learning and to emphasis pedagogy rather than ICT skills. The aim – to provide training opportunities to all teachers who require them - was certainly ambitious. Few training programmes in any sector had ever been on a similar scale. In England training for 395,000 teachers was undertaken by forty-seven English approved training providers (ATPs) at a cost of £450 [for each teacher]. The programme was underpinned by the investment of £1.9 billion in the National Grid for Learning (NGfL). The focus was ICT in the classroom and much of the training was expected to be online. ... However, the programme had a difficult start. The intention that schools would update their ICT skills before the start of the programme was not realised. The idea that schools would receive their Government funded ICT equipment and broadband connections before they started their training was over-ambitious – teachers needed time to familiarise themselves with the equipment and the on-line learning environments were not sufficiently reliable when large numbers engaged (Author2, 2004 part 1: 5).

Considerable scaling up was required in order for all teachers and librarians in England to receive training as mandated by the government. Therefore most providers had to include strategies to train trainers as part of their approach and, in view of the ongoing expansion of ICT in education, this is likely to be necessary for best practice.

Within this national context we contrast A and M, both of which were designed for primary and secondary teachers and librarians. The two designs were significantly different from each other. A non parametric test on the teachers' survey data showed a significant difference between A and M (both n=15, Mann-Whitney U test $z=-3.713$, $p<0.001$). The teachers in A (overall training $M=21.47$, or an average “strongly agree”) reported higher levels of benefits in training than the teachers in M (overall training

M=9.53, or an average “disagree”). The summary of the two approaches in Table 2 is organized across Guskey’s five levels plus a foundational level of opinion about the approach of ICT teacher training including illustrative evidence from each data source, where found. The two designs are now described in detail, starting with the most highly evaluated A.

[Insert Table 2 about here]

Design A: An Organic Approach to ICT Teacher Training

A was strategically and systematically designed to grow out of existing provision within the schools and teacher education provided by colleges and local agencies. The lead organization was a well established college that had provided well respected ICT teacher training across its region for many years. The consortium had negotiated partnerships to include additional colleges and local education agencies. This leadership was supported by a consortium management group comprised of representatives from partners providing the training and the schools that received it. In June 2000 an ICT expert reported that ‘Operationally, the training provision is well managed and administered’ and also that module development and evaluation was continuous: ‘Training has evolved ... and new guidance and materials are generally disseminated via the trainers’ electronic conference and update meetings’ (6/00: 5). In October 2001 the ICT expert’s report noted that ‘Regional evaluation groups, module committees and the consortium steering group help the management team to identify improvements’ (10/01: 6). (Note: The citations following quotes from reports give the month and year of the report followed by the page number on which the quote was found.)

A was evaluated highly on all five of Guskey’s levels by both the ICT experts and teachers (as shown in Table 2). In fact, in the whole sample of 13 approaches, A alone had evidence of impact on student learning. An ICT expert reported that A was ‘organic and sustainable’ (6/00: 5). A provided largely face-to-face training to teachers in a sequence of three modules: (1) teacher’s own professional use of ICT; (2) management skills relating to use of ICT directly with pupils when teaching; and (3) evaluating the impact of ICT on learning. A teacher’s comment in the survey noted that the second

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3 module “was relevant to my teaching.” There was an additional module (4) that enabled
4 recommended teachers to become trainers (described later). For the majority of teachers,
5 the training was located in their own school “using the school’s equipment and
6 resources” (6/00: 4). Exceptions occurred where the teacher was a specialist, e.g. in a
7 secondary subject such as Mathematics, when training led by a specialist trainer took
8 place at a regional venue with on-going support from the non-specialist trainer in school.
9 Each module was adapted to the context:
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16 A strong sense of ownership is cultivated at the school level, even when
17 the trainer is from another school because... training plans are negotiated
18 between the school, trainees and the trainer. This ensures that both
19 individual and school or department needs are addressed. (6/00: 4)
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21 ...Being local enables trainers to provide convenient opportunities for
22 trainees to discuss their progress and receive guidance. The face-to-face
23 training and on-going support enables them to disseminate good practice
24 effectively. (6/00: 5)
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31 In addition to face-to-face training led by the trainer, teachers used workbooks
32 and worked in groups on assignments in their own classrooms. This was supported by
33 case studies of good practice and indicative tasks embedded within the training materials
34 that made “specific links to participants’ professional practice”. Thus resource-based
35 training was part of the approach and these materials continued to grow as provision and
36 good practice with ICT expanded:
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41 An extensive range of materials is available, from which trainers select
42 those that match the training needs of the cohort being trained. The
43 central team continues to identify and develop additional materials to
44 supplement current provision, for example, in early years, music and
45 special educational needs. ...Constructive, relevant, practical tasks are
46 provided for trainees which give them plenty of opportunity and incentive
47 to develop new skills, knowledge and understanding and put these into
48 practice in their classroom (6/00: 5)
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56 Assessment of progress started when each teacher set personal objectives for each
57 module and these were reviewed individually and as a group with the trainer. There was
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also a collective needs analysis for each training group. At the end of each module teachers were encouraged to assess their progress against the outcomes set nationally by the TTA. In addition, at each stage of the training teachers were expected to maintain “a portfolio of evidence identifying examples of their effective use of ICT within their professional practice.”

The consortium’s experienced ICT teacher educators trained the initial cohorts, and then also trained additional ICT trainers. Selection of ICT trainers was rigorous using a structured CV and a recommendation from the trainer’s school. The first step in each trainer’s training was the fourth module followed by ongoing mentoring, which also provided quality assurance: “A training plan is developed by the trainer for each module undertaken by a cohort. Each plan is submitted to the trainer’s mentor for approval or amendment prior to the commencement of training” (6/00: 4). The ICT expert’s second report in 2001 also noted that the approach ensured widespread knowledge of the complaints procedures. Quality was also monitored with teachers’ evaluations at the end of each module and, most teachers’ portfolios were also monitored centrally, in the first year at least. ICT trainers plus their trainers and mentors were continually updated through an online conference and regional meetings.

In summary, design A was school-based and school-focused with additional trainers recruited from within these schools to scale up ICT teacher training. Teachers valued the face-to-face training as well as the materials and ongoing support from trainers. Trainers were rigorously selected and trained and their community shared an increasing collection of resources produced by teachers in training. The community of ICT trainers was supported by an online discussion forum as well as regional meetings. A had all of the characteristics identified earlier: a direct relationship with each teacher’s beliefs, subject discipline and pedagogy; active learning opportunities by teachers developing their own professionalism over an extended period of time with teachers in the same community of practice; coherence with policy and standards, and support for organizational change. In addition, there was a complementary community of practice for the ICT trainers. The contrasting approach M had few of these strengths.

Design M: A Computer-based Approach to ICT Teacher Training

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The consortium that designed, implemented and adapted M was led by a media/ICT company that partnered with other companies and local education authorities. The approach appeared to be based on media production and ICT services, including computer-assisted training. M was designed to provide training to teachers largely through distance learning with extensive ICT-based materials on CD and online, along with curriculum software that was licensed for only six months. The training was structured into three modules that were: (1) teaching (2) learning and (3) curriculum. For primary teachers the modules focused on literacy, numeracy and science respectively, whereas for secondary teachers all modules related to their subject. The extensive materials permitted teachers to focus on one of the four Key Stages of the National Curriculum, or the earlier Foundation level, but each teacher was required to select an appropriate level of classroom based activity that matched their initial simple needs analysis for each module with little or no support from the trainer. The materials also included a CD to develop ICT skills using computer-based training.

Teacher training took place in a cohort of 40 teachers from several schools facilitated by an assigned trainer, who provided pedagogical and curriculum support through an online discussion forum. By 2002, some also used email and phone. Each trainer was responsible for 400 teachers. By 2002, the size of each cohort dropped to 20 and a trainer's maximum number of trainees dropped to 200. Teachers were grouped by Key Stage and secondary teachers were also grouped by subject content. Training was mainly through extensive materials accessed via ICT. Help lines in a call centre were also provided for technical and administrative support. The school principal could opt for one day of training for a member of staff to become the school facilitator and, when the charge was dropped for this support training, its uptake increased from 10% to 60%. The design included standardised assessment activities for each key stage and secondary subject to be collected by each teacher into a portfolio. Assessment against the national objectives was left to the school principal who was automatically provided with certificates for all teachers, regardless of their progress. This delegation of assessment was not received well in the schools.

The first report by an ICT expert perceived the approach as "effective and efficient" (2/00: 2), but as numbers of teachers in training increased, major problems

emerged. These included the inability of trainers to support each teacher's context, problems of ICT access to materials and the online forum, the requirement for school managers to judge achievement before they awarded certificates and marketing promotions which suggested that the approach offered more than it did in practice. A significant proportion of teachers who lacked the basic ICT skills essential for distance learning were unable to participate without volunteer support because: "The lack of skills often relates to manipulation of the on-line facilities" (2/01: 4).

Tables 1 and 2 show that approach M was evaluated by ICT experts and by teachers as ineffective on all five of Guskey's levels. As a result of feedback from the TTA quality assurers, M underwent a fundamental change in 2001: "Instead of trying to 'fit the customers to the basic training model' there is now a clear willingness ... to 'fit the model to individual customer needs'" (5/01: 7). However, the reports noted that in "too many instances the training is still driven almost exclusively by one or more internal key staff, e.g. ICT coordinators" (5/01: 4) and this was confirmed by teachers in six out of the 22 comments provided in the survey. Five of these teachers commented on the lack of differentiation and nine were critical of at least one aspect of the distance learning mode. For example:

I feel that face to face training would have inspired more confidence in the teachers who lacked ICT skills. Instead those of us who were more confident in ICT felt that we needed to provide a lot of help and support to our less able colleagues. I feel this is the trainer's job. Also – the core tasks were basically the same for all regardless of training needs and so were not differentiated according to identified needs. (Teacher comment on survey in 2002)

Although the reports contained little information on training of ICT trainers, there were many critical comments about trainers. This included criticism of the selection of trainers with little current experience in schools who were, therefore, unable to provide advice related to teachers' schemes of work and classrooms. A report noted that "feedback continues to be quite standardised and often short, and hence rather shallow" (5/01: 6). A more ICT expert teacher confirmed these problems with this comment: "Some of the programs didn't load easily and some teachers being trained had their

[trainers] changed more than once and [trainers] did not chase up assignments or provide feedback so everyone had at least 1 incomplete module and in some cases no modules completed at all” (Teacher comment in 2002). The final report noted that trainer problems had been reduced by lowering trainer to trainee ratio and that the one day training for a member of school staff was earlier, with “more time to prepare the school for the start of training” (5/02: 6).

This description shows that the design of M changed from mass produced distance learning, with little direct link to each teacher’s classroom and school, into a more learner-centred approach with better support for schools. It should also be noted that distance learning through ICT was particularly ineffective for teachers who started without skills and confidence with ICT. A key issue was the lack of training for ICT trainers.

Is an Ecological Perspective Valid?

A further analysis was undertaken to assess whether the difference between the two training designs could be explained by adopting an ecological perspective, which was introduced earlier. Our prediction from this ecological perspective was that the highly rated design A would have characteristics that supported the evolution of the current practice in the classrooms and schools with ICT, so that the ecosystems would be more likely to settle down with a new equilibrium with ICT. In contrast, the low rated design M would have characteristics that were more likely to disrupt and stress these ecologies.

An additional round of qualitative analysis tested this theory by reviewing the evidence to identify characteristics that could impact each of the ecologies, positively or negatively. The two designs were compared across the three types of ecosystems for which there was data: the teacher’s classroom, the school, and the training of the trainers. The evidence strongly supports an ecological perspective.

In A, all the characteristics identified supported teachers to evolve their practice with ICT. The evolution of the classroom ecology was supported by individual planning by each teacher and group with guidance by a local ICT trainer and, for secondary teachers, an expert in the discipline using relevant materials. Teacher reflection was also required at the end of each module. This enabled the establishment of a direct

relationship with each teacher's subject content, pedagogy, and belief system, as well as their community of practice. Learning together with teachers in the same school, using the school's software, and often having a colleague as the ICT trainer was likely to contribute to inclusive fitness of behaviour and the co-evolution of the classroom, department, and school ecologies. School leaders who were partners in the detailed design of training their schools also supported evolution with ICT and representative leaders also had an active role in design and monitoring of the whole training approach. A healthy ecosystem was designed to grow support for the training of ICT trainers with the evolution of a community of practice that provided mentoring and shared good materials from teachers' portfolios.

In contrast, many of M's design characteristics were not conducive but were liable to increase the disruption caused by adoption of ICT. The needs analysis and activities were standardised rather than linked to individual teacher's beliefs, and teachers complained that it was very time consuming to locate relevant materials among the extensive collection and to use software that was new to them and to their school. Teachers in the same cohort were not from the same ecosystem and all trainers were also outside the teachers' ecosystems. At a distance, the trainers were unable to appreciate each teacher's curriculum and pedagogy. Trainers were changed more frequently than in A, and those with little experience of schools were particularly unsupportive. Teachers who had low ICT skills or confidence were most disrupted by the computer-based training, and they drew upon voluntary support from colleagues thus spreading disruption. The school's ecology was disrupted with new software that was only licensed for six months. The single day's training for the school facilitator was useful when it took place in a timely fashion, but schools had no further input into the training design. Adjustments to M were ecologically friendly, changing to 'fit the model to individual customer needs' (5/01: 4), including improving the uptake of the one day training.

Summary and Recommendations

The contrast between the two significantly different designs was high:

- A: decentralized growth of materials with increasing numbers of local trainers was accompanied by engagement of school leaders as partners in the training.

- M: centralized training for hundreds of teachers aimed to efficiently deploy centrally published materials. At the start of the training in 2000 this design only offered school leadership one day training for an additional fee.

Both designs used online services: in A, the online facilities mainly supported the development of a community of ICT trainers and their trainers and mentors, whereas in M, the online service was designed for individual ICT trainers to train their cohorts of teachers. Detailed analysis also confirmed Guskey's multi-level evaluation.

Caution is urged in the interpretation of these case studies for several reasons. Case study methodology does not permit generalizations and careful attention must be paid to the context. For example, English schools at the turn of the twenty-first century had around two decades of government investment in ICT in education (Author2, 2004). All ICT teacher training designs were required to follow national standards established for pre-service teacher education, a scholarly approach was specifically excluded, and there was a limited budget per teacher. Also, there were many technical problems in scaling up the online services and it remains unclear whether that is a design or implementation issue.

The case study evidence confirmed characteristics identified previously in the literature and it also fits with Davis' (2008, in press) application of ecological theory to ICT teacher training. More effective training was designed to support each teacher to evolve his or her classroom practice to incorporate ICT plus related evolution of the school ecosystem such that the teacher remained included within his or her multiple ecosystems. In addition, the evidence reported in this paper suggests that the ecosystem for training of ICT teacher trainers also evolved to scaling up ICT expertise plus additional resources to support educational evolution with ICT.

As a result of this study, the related literature, and our reflections on ICT teacher training worldwide, we conclude with four tentative recommendations for the design of ICT teacher training:

1. Take an ecological perspective to design ICT teacher training. Thus, in addition to designing training for each teacher, it is recommended that the approach be designed to promote evolution with ICT in each teacher's classroom, school, college, and region. Also, design for the evolution of the training of the ICT

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teacher trainers and curriculum resources. Build capacity within each school and training organization so that all organizations are supported to evolve with increased adoption of ICT by teachers. For example, recruit and further train additional ICT teacher trainers from participating schools.

2. A community of practice for the ICT teacher trainers is recommended to support their ongoing professional development and the growth of relevant training materials. ICT can be an effective mode of communication for this community because they are mature users of ICT.
3. Computer based training is problematic. Caution is urged with the use of ICT for delivery of ICT teacher training and it is recommended that computer-mediated communication be avoided for teachers who have few ICT skills or little confidence with computers.
4. Incorporate multi-level evaluation of the ICT teacher training (Guskey, 2002) and also include evaluation of the training of ICT teacher trainers.

Acknowledgements

Add later because this identifies the authors.

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Tables

Table 1. Analysis of Reports on Each Training Approach According to Guskey's Five Levels, plus the Experts' Overall View of Each Approach, in Alphabetical Order from most to least Effective (left to right) (From Author1, Author2 and Author3, accepted)

<i>Training approach</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>M</i>
Phase *	P&S	P	P&S **	P	S	S	P	P	P	S	S	P&S	P&S
No of reports analyzed	2	1	2	2	2	2	1	4	2	4	3	3	5
Experts' overall opinion	5	5	5	4	4	4	5	4	2	2	1	1	1
Guskey 1	5	5	5	5	3	4	4	2	4	2	1	1	1
Guskey 2	5	5	5	4	4	4	4	2	5	2	1	1	1
Guskey 3	5	5	5	5	5	4	4	4	0	0	1	0	0
Guskey 4	5	5	5	5	4	4	4	4	3	2	1	1	1
Guskey 5	5	5	5	3	3	3	3	4	3	1	1	1	-1

* Phase: P: Primary; S: Secondary; P&S Primary and Secondary; ** Specialist

Key to judgments used by the researchers in analyzing the quality assurance reports of each approach of ICT teacher training

<i>Value</i>		<i>Description</i>
0	Missing data	Not part of the approach OR never mentioned
-1	Negative	The training temporarily impacted the pupils negatively
1	Strongly disagree	Ineffective from start
2	Disagree	Poor, or introduced after the start with no or mixed opinion
3	Neither agree/disagree	Present, but no opinion OR mixed opinion
4	Agree	OK, or promising by end
5	Agree strongly	Very effective from start, or very effective at end, or both

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Peer review only

Table 2. Evidence of Guskey's (2002) Levels for ICT Teacher Training Designs A and M, from the Survey of Teachers and the ICT Experts' Reports

Guskey's critical level: Brief description	Questions used in the survey (see key below)	Approach A			Approach M		
		Teachers reactions as gauged by the survey (mean values; N=15)	Comments from teachers' survey (N=5)	Quotes from ICT expert (2 reports) (month/year: page)	Teachers' reactions as gauged by the survey (mean values)	Comment from teachers' survey (N=11)	Quote from ICT expert's report (5 reports) (month/year: page)
No Guskey level: Training approach's effectiveness	Q 9	3.87	None available	The provider has successfully sustained good quality training provision (10/01: 2)	2.00	Experience was stressful throughout.	Overall this is an effective and efficient model (2/00: 2) Changed: the quality of [trainer] support remains less than satisfactory (5/02: 3)
G1: Participants' reactions	Q 3, 4, 5 & 7	3.70	(1) I like [the] individual follow up and the chance to see demo lesson[s] (2) I found the sessions with the trainer based at school reasonably useful, ...	Trainees are enthusiastic about the training. ... In fact, the results are the best yet received from any provider. (10/01: 4)	2.30	There was no differentiation apparent in our school, despite a huge range of knowledge and skills. It was excessively time consuming	The majority of trainees continue to ... report that they do not have a valuable learning experience, even if they make progress through the training tasks (7/01: 3)
G2: Participants' learning	Q 6, 8	3.87	[Module 2] was relevant to my teaching	Trainees identify their training needs ... they set personal objectives which they review at the end of the module. This helps them to acknowledge the progress they have made and to identify the further development they need. (6/00: 5)	2.37	Did little to improve any awareness, skills or understanding	Most trainees report that their learning experience is extremely shallow ... although they work through the tasks... they do not really have a genuine pedagogical learning experience. (7/01: 3) Only around 50% of trainees make sufficient and timely progress (5/01: 4)
G3: Organizational support and change	None available	None available	None available	... there is usually strong whole school or department support - often the training is reflected in the school development plan and in performance management. (10/01: 4)	None available	There was far too much emphasis on completing set tasks and not allowing us to adapt the model to our own experiences.	...redesigned information booklet for senior school managers (5/01: 3) Most [trainers] do not really take account of the local situation of school teachers either, partially because they know little about it – being based

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							elsewhere – and partially because they do not make use of the information which they receive from trainees (7/01: 9)
G4: Participants' use of new knowledge and skills	Q 1, 2	3.83	During my training I included ICT in my schemes of work	The training is having a very positive impact on trainees' professional practice. There is clear evidence of impact at both individual and school level. Examples include: • better quality teaching materials that incorporate visual material and are differentiated to cater for pupils' different learning needs; (10/01 : 5)	2.67	Negative: (1) Many tasks seemed pointless to me for I was quite experienced at using ICT (2) Although I have successfully completed this course it successfully destroyed all my confidence in using a computer	None available
G5: Students' learning outcomes	None available	None available	None available	... the use of modelling software in science that improved pupils' understanding and retention of knowledge, as shown by higher test results in the relevant teaching units • the effective use of Smartboards led to schemes of work being revised as pupils were found to make faster progress in their learning than previously. (10/01 : 5)	None available	None available	None available