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Using evidence about teacher development to plan systemic revolution

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ABSTRACT

In England and Wales Information Technology (IT) is to be used to support the teaching of all subjects; in addition, all students have an entitlement to IT capability. Data from several surveys are reported, which do not match this vision of IT. Rather, IT is seen by teachers to be concerned with the acquisition of technical skills, or as a support for administration: a small number are terrified of IT, rather more are unconvinced of the benefits of IT, and only a minority of teachers use IT to support their teaching. Teacher concerns regarding IT are reported. Finally, the paper offers a model of school development which highlights the changing demands on teachers as IT is integrated progressively into the curriculum.

Keywords: innovation, management, integration, case studies, attitudes

INTRODUCTION

The main challenges we face when attempting to integrate Information Technology (IT) into educational practices are concerned with creating and maintaining an educational climate where steady change in teacher knowledge and classroom practice is accepted as a desirable state, planned

for, and supported appropriately. These changes are not simply changes of content - a shift from studying the Romans to the Renaissance, or swapping statistics for algebra - rather, they pose deep questions about the most useful things students can learn in school, and about the uses of the most powerful intellectual supports we have.

In any change process, it is essential to have a view of where different key agents are, in terms of both their actions and beliefs, and to plan changes on the basis of this information. Change is not just a matter of skill development, or the reform of individual attitudes - change needs to be embedded in a nurturing institutional context. It is clear that individuals can develop on their own, but for IT to be integrated across departments, and the school curriculum, a broad range of institutional issues must be addressed, which include the provision for the development of individuals who do not necessarily share the institutional vision of IT.

This paper begins by setting the scene in England and Wales - where a national curriculum has been introduced which requires that students learn using IT, and become fluent users of IT itself. It then presents evidence gathered from case histories of schools, survey data, and interviews. Surveys of teacher attitudes, and structured interviews show that a large proportion of teachers make little use of computers in their teaching, and that a significant number actually express a fear of the new technology. Of the teachers who do make use of IT, many make poor use, and misperceive the rationale for IT in education. Schools differ a great deal in the extent to which IT is integrated into their curricular practices, and surveys and case studies show a wide variety of perceived and actual issues (for example, software choice, equipment deployment, phasing of staff development) which schools need to address.

We offer an account of the stages of IT development in schools and how this relates to teacher development, and describe the approach used by the STAC project to support the integration of IT across the curriculum.

CURRENT IT USE IN EDUCATION

The National Curriculum in England and Wales is specified largely by subject (for example, Science [1], and English [2]). Statutory Orders set out Programmes of Study which must be followed, and define Attainment Targets (ATs) which should be reached, in each subject; these ATs refer to different domains within each subject, such as Shape and Space, and Handling Data, in Mathematics [3]. They list things students can do, in ascending order of difficulty. References to the use of IT in teaching and

learning appear in every one of the Statutory Orders; so every student is to receive teaching which is based on IT in every subject in the curriculum, and it follows that all teachers are expected to be able to use IT as a teaching aid. IT capability is also defined as a subject area within the Technology Statutory Orders [4]. This is a broad conception of IT literacy which sets out ATs under the headings of: Handling Information; Communicating Information; Modelling; Measurement and Control; and Applications and Effects. The National Curriculum, then, identifies two distinct roles for IT; one is as an end in itself, to empower students by developing their abilities to use IT as a tool whenever it is needed; the other is as a support for learning in every curriculum subject.

What changes in IT provision are apparent?

What progress has been made so far? Schools have had just 3 years since the introduction of the National Curriculum. Some idea about the changes in the sorts of activities which can be supported via IT come from a recent evaluation into the effectiveness of the computer support system in one Local Education Authority [5]. In 1988, the 44 secondary schools had 782 computers, and in 1993, they had 2207. The computer - student ratio fell from 1:45 in 1988 to 1:14 in 1993 (the best equipped school had a ratio of 1:5, the worst was 1:25). There has also been a change in patterns of purchase, with a steady increase in both the number of laptop computers and printers being purchased, a steady increase in the use of the LEA library of CD-ROMs, and very large increases in the number of blank disks being purchased (from 50 in 1989-90 to 3080 in 1992-93).

Of course, computers and software packages have increased dramatically in power over recent years, and continue to do so. Technical innovations such as laptop computers and CD-ROM offer educational opportunities which we are just beginning to explore, but which offer the potential for new ways of working in education.

In order to make good use of these developments, a climate of experimentation, and acceptance of short term failure, the use of methods to promote the rapid dissemination of effective educational practices, and a willingness to accept steady change as a way of life, will be essential. Such climates are difficult to create. In order to begin the process of change, it is necessary to have some knowledge of teacher beliefs, their knowledge of and current classroom uses concerning IT.

What do teachers believe IT is good for?

An unpublished survey of 54 primary school teachers by Gower [6] explored teacher knowledge of the National Curriculum, and beliefs about

the benefits which can accrue from IT. Twenty six out of 54 teachers were unable to name correctly a single skill contained in the Statutory Orders for IT. Eleven out of 54 teachers identified skills which are not there at all: notably skills relating to keyboard skills, co-ordination and movement. So the idea of IT capability as a set of general purpose skills which can enhance personal effectiveness is not well understood: rather, IT is seen as a set of technical skills.

Teachers were asked about the benefits which accrue from the use of IT. Open format responses were then categorised under different headings. The number of teachers spontaneously offering remarks under each heading are shown in Table 1 below.

Benefits of IT use	% Respondents
Low level cognitive skills	52
High level cognitive skills	33
Personal skills	30
Social skills	17

Table 1: Percentage respondents who indicate particular benefits of IT use (n=54) (Gower, 1992)

These data support the earlier conclusions; the dominant use of IT is to develop technical, rather than conceptual, skills.

The STAC Project offers a consultancy service to schools. Consultancy consists of an analysis of current human and physical resources (elicited via a questionnaire to staff, structured interviews with about half of the school staff, a review of the school prospectus and other materials they have produced, and direct observation of classroom practices), and recommendations for future action. Consultancy is an essential part of our work - while the primary goal is to offer direct advice to individual schools, a secondary goal is to keep STAC in touch with current teacher concerns about IT and the state of school development in general. To share some of this knowledge with a broader community, we publish some consultancy reports, with the permission of the school concerned. Of consultancies conducted so far, 3 are available in published form [7], [8], [9]. Data from these reports are presented below.

In one school, teachers were asked about the uses they saw for IT. Their responses were categorised and are shown in Table 2 opposite.

Teacher Perception of IT	Number of teachers
Administrative tool	18
Teaching tool	16
For skill development	14
Support learning	12
Material production & presentation	10
Games, or for playing	9
Something to know about	5
Motivates children	5
Bandwagon	3
Expert tool	2
For programming	2

Table 2: Teacher perceptions of IT from an interview survey with 66 staff in one school (n=66) (Passey and Ridgway, 1992)

The commonest single response was to see IT as an administrative tool. Overall, the responses were rather sparse - for example, there were only 46 responses from 66 members of staff which related to educational uses. Further, 16 responses are concerned with what the teacher does rather than what the student does, 14 responses refer to skill development, and 4 responses are unrelated to the National Curriculum view of needs for developing IT Capability. Only 12 responses are concerned with the support that IT can offer for learning. These data show that in this school, educational ambitions for IT are somewhat modest.

In two schools, staff were asked to categorise their use of IT on a scale which ranged from 'IT terrified' to 'IT curriculum user'. Their responses are shown in Table 3 below.

How teachers viewed their use of IT	Report 1* n=66	Report 2** n=53
IT terrified	5% (3)	10% (5)
IT unconvinced	20% (14)	8% (4)
IT convinced (but not using IT in lessons)	30% (20)	28% (15)
IT administrative user	25% (16)	51% (27)
IT curriculum user	45% (30)	51% (27)

Table 3: How Teachers in Two Schools Viewed Their Uses of IT (* from [7], data collected 1991; ** from [8], data collected 1991)

Teachers who are terrified of IT need careful nurturing; those who are unconvinced need some persuasive communication, those who are convinced, but who do not use IT in lessons, need vivid exemplification, resources and encouragement, and curriculum users probably need encouragement to push forward their IT uses, as well as encouragement to help others.

Experience reported	No. of respondents
Inexperienced	19
Some experience	16
Experienced	4

Table 4: The Way in Which Teachers Reported their Level of IT Experience in One School (n=39) (Passey, 1994)

Classroom Use	No. respondents
Used at least one per week	5
Used occasionally	21
Used never	11

Table 5: The Regularity of Classroom Use of IT Reported by Teachers in One School (n=39) (Passey, 1994)

Similar evidence was gathered from a third school consultancy, and data are shown in Tables 4 and 5. The modest use of IT in classrooms can be compared with statistical evidence from the Department for Education (DfE) [10] which reported in 1992 that 32% of all teachers in all secondary subject departments were using a computer in class at least twice each week. DfE data contrasts with data from the Impact study [11] where just 12% of teachers used a computer at least once per week. School consultancies produce a long list of teacher concerns about IT. Some of the major concerns are listed here:

- beliefs about why IT is being introduced into education (e.g. a misplaced belief about the needs of employment, a plot to save teacher salaries) and what IT is really good for, in educational terms (e.g. playing games, and drill and practice);
- concerns about change itself, such as the number of changes taking place at the same time, and the uncertain nature of government planning - will these changes still be required in a few months?
- time pressures;

- loss of traditional skills, such as handwriting, spelling, and mental calculation;
- IT can be seen to be irrelevant to the teaching of their subject, which can be done better, and more cheaply, in other ways;
- quality of software, and its match to the existing curriculum;
- personal confidence and competence;
- inversion of roles, where students know more than teachers;
- resource implications - direct and indirect costs, and the need to replace equipment regularly;
- problems of access by staff and students;
- security; the problems of vandalism; and file security for the work of students and teachers;
- electrical safety;
- worries about radiation associated with prolonged working with screens; and
- space, and a loss of flexibility in room uses.

What sort of support is appropriate?

Teachers are always asked how they learn most effectively. In School 1, 45 reported that it was by doing, 19 indicated that it was by working alone, 16 by discussion and talking, 15 by working in a group, 10 by reading, 10 by observing, and 8 by listening. If self report matches actual learning style, these data suggest that most teachers would benefit from using IT in their classrooms or having direct access to it, and from group work and discussions. An innovatory feature of teacher support in England and Wales has been the provision of advisory teachers, who work alongside other teachers in class. This sort of support is expensive to provide, but seems well suited to teachers' self-reported needs.

When questioned about perceptions of themselves as teachers, 39 teachers felt they acted as a facilitator; 30 indicated that they felt they acted as an instructor; 9 as a trainer; and 11 as a coach. These data offer hope for the development of IT capability.

APPROACHES TO CHANGE

Why should teachers change? Change is likely to succeed when it lets one achieve goals which are hard to achieve in other ways, it makes life more fun, it makes life easier, and when it is seen to be desirable by the community at large. Many failures to innovate can be predicted in advance, because they fail on too many of these criteria. These criteria

contain an implicit agenda for change. Early stages should focus on achieving desirable goals which are hard to reach in other ways (such as supporting problem solving in groups, developing writing skills, inculcating modelling skills), while providing positive classroom experiences for teachers and students. These stages should be attainable without a massive investment of time by the teacher. They should lead onto pleasant classroom experiences, which actually make teaching easier, and the educational gains by students should be judged to be valuable by the students themselves, by other teachers, by parents, and by people outside the school community.

Innovations are likely to fail when they challenge fundamental values and practices, are associated with over ambitious claims by advocates, underestimate the practical constraints of resources such as time and support, are based on exemplary practices, not typical ones, ignore the starting point of the individuals involved, fail to monitor progress, and adapt the programme appropriately. We return to these themes later.

How can institutions change? In our work, we have used survey data to elicit a set of issues which schools commonly identify as barriers to change, and have then used advice from advisers and advisory teachers, the existing literature, our own insights, and evidence from case histories, to show how barriers can be overcome. Of course, the reward from overcoming any barrier to the integration of IT in education is not to succeed - rather it is to face a more interesting and challenging barrier - so lack of hardware is replaced by the need for staff development, which creates a demand for more and better hardware ... and so on. An important outcome from our analyses is a set of ideas on developmental stages along a number of dimensions, which can be used both to describe the current state of development of any school, and to offer advice on what the next stage of development to be tackled is likely to be. The analytic framework is flexible, yet it leads to specific advice for action. Investigative tools are well developed; strategies for progress are grounded in case studies of things that have worked well, elsewhere, yet the framework is not prescriptive - the order in which major barriers are tackled is not pre specified, and a number of routes can be taken to circumvent any given barrier. One way to conceptualise change is offered in Figure 1 opposite.

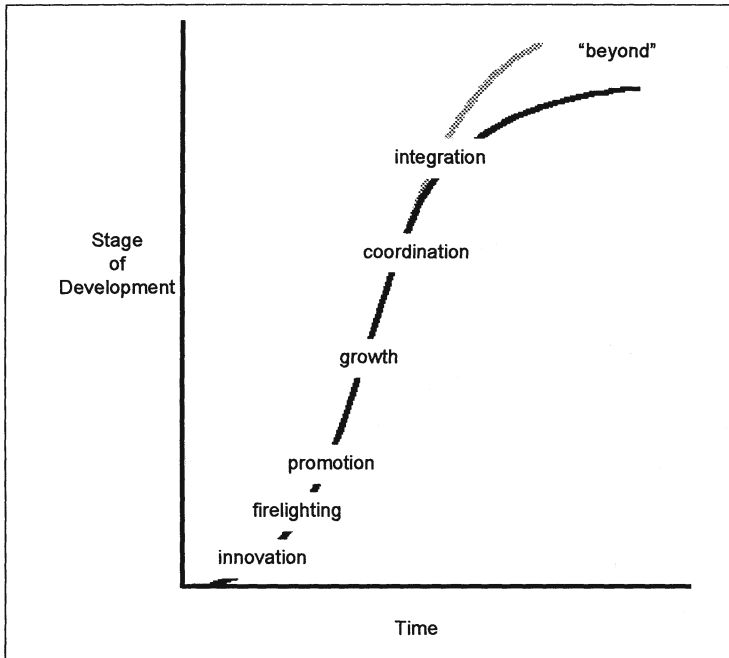


Figure 1: Observable stages of school IT development, adapted from Passey and Ridgway [13]

At a school level, our observations show that the integration of IT into whole school practice takes a minimum of 3 years, and that schools go through at least seven discernible stages in reaching this position (taken from [12]):

- innovation (when one person is finding out what IT is and how it can be used);
- firelighting (when that person is trying to persuade influential people in school about using IT);
- promotion (when school management actively supports the development via INSET, and extra resources including time)
- growth (when teachers begin to use IT more widely, and demand can rapidly outstrip the available resources);
- co-ordination (when the need to monitor students' total experiences becomes urgent);
- integration (when most teachers use IT, a stable state is reached, and IT use is planned and co-ordinated); and
- extension (when new educational uses for IT are explored, and built into students' everyday experiences).

An important insight is that different stages concern teachers with different levels of expertise and autonomy. Initially, development can be entrusted to autonomous enthusiasts; later far more control and central planning is needed. It follows that quite different development needs are met at each stage of development.

A matrix of development produced for the NCC [14] shows the factors which STAC has identified as being important to institutional IT development at each stage. Schools can use this matrix to identify where they are, the factors needing to be considered next, and ways to plan activities to reach their long term goals.

A sample from the entire matrix is given in Table 6 opposite. The sample has been chosen to highlight aspects of school development which relate directly to teacher development.

Our observational evidence (from one day visits to some 24 schools per year), and that from Stephen Steadman [15] indicates that most schools are at the stage of 'Promotion'. Many co-ordinators at the ACITT Conference in Bath (July, 1993) reported that their schools were at the stage of 'Growth'.

Given the current state of development of most schools, and from the time scales which our schools are prepared to consider seriously, we believe that the majority of UK schools will take between 3 and 7 years to reach the stage of 'Integration'. Reaching this point will be completely dependent upon the direct support of senior management in school, the continued commitment at the national level to a strong role for IT in the curriculum, and to the provision of extra physical resources and support. Our model to support systemic change is set out in the chart opposite.

CONCLUSION

The STAC approach to school change is as follows:

- find out where the school is, in terms of teachers' knowledge, current practices, and willingness to use IT;
- establish reasonable constraints:
 - what physical resources could be made available, and sustained in the long term;
 - how many teachers, and in which departments, are willing to become more involved with IT in their teaching;
 - what training could be undertaken, in what time scale;
- establish a range of possible future developments at departmental level, which all fit these constraints;

	Stages of Development		
Factors:	Innovation	Promotion	Co-ordination
IT is a priority for	individuals	supportive managers	the majority of teachers
teacher awareness of IT use	individuals	increasing numbers of teachers	the majority of teachers
focus of development	self motivated individuals	departmental groups	whole school
roles and responsibilities of staff for IT use and development	defined by individuals and seen by the majority as not their problem	spread widely, but not necessarily understood or universally agreed	agreed and understood by all
forms of staff development	self determined	awareness raising	sharing classroom practice
teaching styles employed in using IT in lessons	specified by one IT expert teacher	explored by small numbers of teachers	wide variety, known about within and across departments
departmental deployment	IT is a specific subject department	each department finds advantageous uses of IT	school development is planned according to department willingness and readiness
student awareness and IT use	restricted to particular lessons	increasing use of IT in lessons outside specialist ones	use of IT in all lessons is co-ordinated
assessment and recording of IT capability	done by one person, if at all	some information about students shared across staff	schemes are in place; teachers understand what is to be learned, and how this can be recorded

Table 6: Examples of factors which influence the integration of IT at different stages of development (Passey & Ridgway, 1993)

70 *Integrating information technology into education*

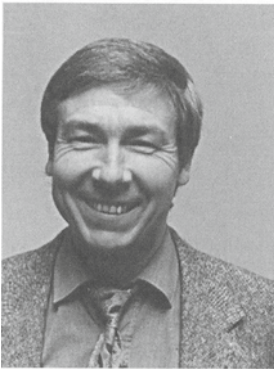
- look at the curriculum impact, from the students' viewpoint, of rival possible future developments;
- make recommendations on the basis of the likely coherence and progression of student experiences;
- offer suggestions on how developments can be monitored as they progress.

A range of tools are available to support this process [13]. More are needed. A large number of case histories of schools attempting to integrate IT are necessary in order to build up a broad conceptual understanding of the nature of IT-related change. The uses of IT in education are at a rudimentary stage; the long term potential of IT to shape our conceptions of the nature of learning and knowledge, and the ways that education is conducted, is largely unknown. We believe that the most powerful agents of change are classroom teachers, and that their concerns, beliefs and competencies must be a central focus for professional development.

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