 secondary teachers’ perceptions of computer availability: a qualitative study

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ABSTRACT Twenty-seven semi-structured interviews were conducted with teachers of secondary mathematics from different English schools. This paper describes their perceptions of computer availability and the impact of those perceptions on their professional activity. Every represented school had at least one computer room with the median being two. The number of such rooms was not necessarily a function of school size. Most teachers indicated that computer rooms were available less frequently than they would have wished. The few who expressed satisfaction tended to work in departments with their own facilities, although frequently these amounted to unreliable machines cast off by the technology department as newer machines became available. Most teachers had easy access to single, stand-alone computers although these, too, tended to be superseded machines which few used. Teachers tended to express ambivalence in respect of their use of single computers. A speculative rationale for a more productive deployment of computers in schools is proposed.

Introduction

The last decade has seen undoubted growth in the numbers of computers in English schools. Indeed, government figures indicating continuous growth (Table I) compare favourably with those abroad (Pelgrum & Plomp, 1993a). Despite this there is evidence of insufficient machines for the satisfactory delivery of all curricular demands. In mathematics, for example, a shortfall has been noted between pupil-computer ratios and the five-to-one necessary for the fulfilment of its National Curriculum (MA/ATM, 1991). Also, despite what may be described as an encouraging average, individual schools differ widely in their respective provisions. The ImpacT team, for example, found pupil-computer ratios ranging from 8:1 to 43:1 in the secondary schools it investigated (Watson, 1993).
Table I. The ratio of pupils to one computer in English maintained secondary schools from 1985 to 1994.

Furthermore, reports continue to be published indicating that teachers believe there are too few computers for them to be used effectively (CERI, 1989; Zammit, 1992; Andrews, 1995). The reasons for this are several and many were well-expressed some time ago. Selwood (1988, p. 3) noted that, as teachers become aware of subject-specific possibilities, ‘demand for access to the school’s limited supply of computers’ increases. Such demands have been exacerbated by computers being placed in laboratories so that ‘teachers of non-computing subjects have in fact been denied access or given only limited access to the computers’ (CERI, 1989, p. 20). Indeed, as Phillips (1986) observed, ‘if all the computers are kept in a computer room, if they are difficult to move, or difficult to book, no one will use them’. Moreover, the practice of putting machines into specialised rooms encourages special lessons in IT (Ball, 1987) which further undermined the assimilation of computers across the curriculum (CERI, 1989). Papert (1994) has argued that the placing of computers in laboratories was inevitable – a reactionary institutional response to radical attacks on established educational practices. The National Curriculum for England and Wales, the statutory curricular obligations which teachers working in state schools must fulfil, has, in respect of IT, exacerbated the problem further. IT was presented, initially, as worthy of study because it can enhance learning and provide pupils with knowledge and skills for later life (NCC, 1990). Importantly, there was an explicit acknowledgement that IT can facilitate children’s learning of other subjects to the extent that its delivery was expected to occur in contexts where it is an appropriate medium for teaching and learning (DES, 1990). Thus, for example, children might have been expected to acquire spreadsheet skills within a context in which the mathematics on which they were working was derived from data yielded by the software. In short, the original focus placed much of the burden of IT teaching on subject departments and increased substantially the demand placed on the limited number of machines in schools. Indeed, whereas in earlier days computers may have been used by enthusiastic individuals, more recently much larger numbers of teachers have had to access the same facilities. Recent changes, due to industrial action instigated as a consequence of teachers’ perceptions of excessive curricular demands (Robinson, 1995),
precipitated a shift from notions of IT enhancing children’s learning of other subjects to a renewed focus on preparing children for later life (SCAA, 1993, 1994). The expectation that subjects should assume some of the responsibility for the delivery of IT remained with a statement similar to ‘pupils should be given opportunities, where appropriate, to develop and apply their information technology (IT) capability in their study of mathematics’ (DfE, 1995b, p. 1) appearing at the head of each subject curriculum document. However, such shifts in emphasis, which raised the status of vocationally oriented subjects like IT, technology and business studies, further intensified demand on facilities.

Thus, the evidence indicates that despite a variety of initiatives which “provided manna from heaven to... enthusiasts whose aim was to fill the school with microcomputers and associated bits” (Wellington, 1990, p. 58), demand, in most schools, appears to surpass the limited availability of facilities. The following research describes an interview investigation of secondary mathematics teachers’ perceptions of computer availability and attempts to explore whether the further passage of time has led to both improved access to facilities and more propitious conditions for the fulfilment of their curricular requirements.

**Method**

Semi-structured interviews were conducted with twenty-seven teachers of mathematics from different secondary schools in England from 1992 to 1995. Informants were volunteers following two postal surveys of all teachers of mathematics in a range of secondary schools chosen at random from across the Greater Manchester conurbation. The surveys, which were ‘intended to explore aspects of teachers’ attitudes towards, understanding of, and levels of engagement with, information technology (IT) in respect of the teaching of mathematics’ (Andrews, 1996, p. 303), and subsequent interviews were conducted during the academic years 1992/93 and 1994/95. Full details of the manner in which the sample was identified and the procedures invoked for the interviews have been described elsewhere (Andrews, 1996). Each interview, which was tape recorded, lasted around 30 minutes and was transcribed as soon after the interview as was practicable. Copies of the transcripts were posted to the teachers concerned in order to confirm their accuracy. No informant challenged the content of his or her transcript.

Content analysis was achieved through a process of reading and re-reading until it was clear that categories were emerging (Saran, 1985; Nias, 1991). In reality this meant that each transcript was read twice to gain a sense of a teacher’s perspectives and to facilitate the identification of common themes. Each transcript was then coded according to the following mechanism. Each
theme was allotted a colour and any reference to it was marked accordingly in the margin. Frequently themes overlapped or teachers alluded to several simultaneously. In such cases several colours would have been used. On completion all references to a given theme were copied from each transcript and pasted into a new file dedicated to that theme. This was done in such a way as to maintain the integrity of sources. Each of the dedicated files was read repeatedly in order to gain a sense as to how informants, in general, had spoken on that particular theme. Several areas of common interest or concern were revealed. This paper focuses on teachers’ perceptions of computer availability and how it impacts on their exploitation of IT in the teaching of mathematics.

**Results**

All interviewees commented in some detail on the availability of the computer facilities within their schools. Comments ranged from details about computer laboratories and the types and number of machines within them to the availability of single computers within classrooms. Throughout the following account are references to BBCs – 8 bit, 32k machines made by Acorn Computers in the UK – which were purchased by many British schools throughout the 1980s. Their ubiquity was a consequence of a government ‘home grown’ only policy for schools’ computer purchases (Hawkridge, 1987).

*Provision of Computer Suites*

Informants confirmed the existence of at least one computer suite in each represented school, although there was considerable variation in the provisions described. Few teachers spoke of the numbers of machines in their computer rooms although those that did indicated that there were rarely less than 15 machines with the norm appearing to be around the low twenties.

The following is premised on a notion that discussions based on absolute numbers would be pointless because such figures, when removed from their respective contexts, become meaningless. A more meaningful figure, which facilitates comparison, was thought to be the pupil to computer-room ratio. Full details can be seen in Table II.

The most favourable ratio was 164 in a school of 850 pupils which had recently acquired ‘technology college’ status. This particular school, as a consequence of a competitive bidding process aimed at breaking the perception of underachievement frequently associated with inner city schools, had attracted, direct from central government, substantial additional technology funding. The least favourable ratio was 1250 pupils in a mixed
comprehensive to one computer room containing sufficient BBC machines for a class of ‘children to work three to a computer’. The median was 440 and the mean 499.

<table>
<thead>
<tr>
<th>Number of pupils in school</th>
<th>Computer rooms</th>
<th>Pupils:1 computer room</th>
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<tr>
<td>450</td>
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<td>4</td>
<td>370</td>
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<tr>
<td>820</td>
<td>5</td>
<td>164</td>
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</table>

Table II. Overview of IT in each of the schools surveyed.

Access to Computer Suites

Five teachers spoke of their departments having its own computer suite. Two of these worked in schools which had been awarded technology college funding and described enviable facilities. The others spoke of their acquiring
sets of redundant, in respect of IT, machines. One commented that “it's been a problem of access to them until recently, but we have got better access now, because there’s a new computer suite in the school and we’ve inherited the old one. There are maths lessons going on in the old computer room all the time, so we've got a suite of BBC computers that we can use.” Another was less sanguine and suggested that they had acquired “... second-hand, passed down machines, BBC machines ... which are now very, very unreliable. They were unreliable when we had them but now they’re even worse and it's a very frustrating process when the software doesn’t load properly. The children get annoyed and so on.”

Access to such rooms was not felt to be a problem and generally involved little more than a negotiated room change with the incumbent. The least favourable scenario was when

... there’s a class in there but it’s one of the maths department teachers and so it’s a maths class so that it would be reasonably easy. I think it would be polite to give twenty-four hours notice, at reasonably short notice you could swap.

Two thirds of the remaining interviewees described poor access to computer rooms. A deputy head and former head of mathematics commented that: “The position with access is difficult in that we have two computer rooms in school and every child has a double of IT per week, which therefore makes the spare capacity on the rooms difficult.” Another suggested that, despite his school having three rooms equipped with relatively up-to-date personal computers, he would be unable to book one “... because they’re booked up all the time with IT ... years seven and eight also go in English as well and they learn how to use word-processors.”

Five teachers indicated reasonable expectations of gaining access to computer suites in the sense that they “could book a time and ... take them in to teach spreadsheets or logo”. One commented that access appeared unchanged by increasing numbers of computers: “there’s more IT taught, there’s more keyboarding taught, and therefore the availability’s about the same. So they’re used more on a regular basis by other teachers. They are fairly available as long as you book them in advance. If you’re teaching a class four periods a week you can usually get three of those four. So you can have continuation of teaching.”

Two teachers claimed better than adequate access to computer rooms. One, who worked in a school with a successful, income generating brass band, commented that as computers were superseded, the mathematics department was able to avail itself of the newly unwanted ones. She acknowledged, also, her school’s unusual position, “money isn’t a problem, we can basically say, ‘Can we have some more computers?’ and we’d probably get them at some stage.” The second commented that mathematics and
technology were housed in a building separated from the remainder of the school by a substantial open air walk; there was a computer room in both buildings and most staff tended not to leave their particular area. Of the computer room in her block containing BBC machines, she said, “it’s a whole-school facility but it’s in this building. In this building you’ve got three maths rooms and the technology department ... You have to book it but it’s not, I mean, it’s not overly used. You don’t have any problems.” Teachers’ comments seemed indicative of poorer access to computer suites than most would have wished. A few taught in well-equipped schools but most did not. Indeed, one mentioned that her school’s computer room contained personal computers with 186 processors which were unable to run the sort of software her department wished to use. Several teachers spoke of the significance of managerial decisions in respect of computer purchase and deployment. One described his school’s leasing agreement which allowed for the replacement of superseded machines. Another commented that his school’s decision to stay with a particular manufacturer had necessitated regular and expensive upgrading and that he foresaw a time, within the near future, when they would all need replacing at prohibitive cost. Another spoke of her headteacher’s inability to cope with technological arguments:

One of the problems that we also have is that the Head is not really au fait with IT. He thinks if you’ve got six BBCs in one room, six Archimedes in another and you fetch three Apple Macs in then it’s OK, you’ve got enough for a class. He doesn’t understand the differences between the systems. He thinks you can just link them all up together and it doesn’t matter that they’re different.

Others spoke of other difficulties. One teacher commented that the “physical side of ... having to trail the class down to the computer room” was enough to prevent his bothering. Another noted that using the computer room “... takes a bit of setting up, because none of them have got hard disks so it’s a matter of me going round and banging it in, loading it, going to the next one, banging it in, loading it.”

Access to Single Computers

Several teachers commented on the provision of single, or stand-alone, computers in their schools although many saw little value in their using them. This concern was typified by one teacher who commented that “I really think that one computer in the classroom is virtually useless. I think if the kids are going to get anything from it they’ve got to get some hands on experience.” Frequently, it seemed, single computers were redundant machines cast out by the technology department. One teacher, who taught both mathematics and IT commented that “we’ve not done away with [older computers] but we’ve farmed out BBCs to other areas”. Another, despite his
acknowledging the range of machines available to him, said that “we get all the rubbish that nobody else wants that the kids have wrecked. It’s terrible.” The numbers of such machines varied widely. Several spoke of their departments possessing just one or two BBCs on trolleys. One, with poor access to her school’s two computer rooms, outlined the logistics of getting the machine to her room:

The maths department has one computer, but it’s locked away somewhere. ... J. (head of department) said I could have it as long as I took it backwards and forwards every day. But the store room’s just miles away ... You go out of the classroom, which means going down the steps, it’s on a trolley as well, and you have to walk across the playground and in the far door there, and then down the corridor and then you turn right through some double doors and then down some stairs ... It is impractical, basically, because of all the stairways and the fact that I have to go outside and at the end of each day I’ve got no security in this building really so it would mean I’d have to take it back every day.

Security was an issue raised more than once. A typical comment was that “there is no way that we can have computers in our maths rooms because we cannot secure the school premises to enable us to do that.” At the other extreme a few teachers spoke of an abundance of such machines. One commented that: “We’ve got a hundred, no, loads of BBCs floating around that we sometimes set up in clusters. The technology department uses those for control. We used to have a cluster of six just outside and anybody could go and work on those outside, and that was quite good. But then we grew out of BBCs.” Several spoke of there being a single computer in each mathematics classroom. The reactions to such provisions were mixed. One commented that: “I’ve got a Nimbus [similar to a PC] at the back of the room that I’ve used with two first year classes for a database. They’ve put information in and then we’ve looked at it as a class. But it’s very limited what you can get out of it doing it like that. You can get some points out but they don’t get any real hands on experience and so it’s a waste of time.” A few schools had attempted to alleviate problems of access by networking the school and providing single machines in each classroom. “So what we’ve done is we’ve networked the school ... in maths we have ... BBC computers which we can plug in and use”.

Of the 16 teachers who commented on single computer availability, 12 described the machines as BBCs which lends support to the notion of their being cast-offs from technology. Frequently these appeared incompatible with the machines used in IT. One said of the stand-alone computer to which he had access, “it’s a BBC, not an Arc. The kids are used to using the Arcs for the spreadsheets”.

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Discussion

There were computer rooms in every school, which accords with earlier studies (Wellington, 1987; Zammitt, 1992; Owen, 1992), although levels of access were variable (Byard, 1995). This was not unexpected as schools’ budgets are commensurate with the number of pupils on roll. In many schools computer rooms designated as whole-school facilities tended to contain relatively modern machines running sophisticated graphical user interfaces (GUIs). In general these were PCs or Apple Macintoshes. However, this was not always the case – a few informants reported that their schools only had old BBC machines or very early PCs with, say, 186 processors. Some schools had computer rooms designated to mathematics departments which required teachers to negotiate room changes. However, frequently such rooms were a consequence of old and unreliable machines being passed down from IT. It is of interest that the apparent prevalence of old machines accords with other recent surveys. Goldstein (1997), summarising the findings of schools’ inspectors, noted that IT equipment was “poor in about one third of (secondary) schools” (p. 11) whilst Stevenson’s (1997) independent inquiry found that “much of the hardware in schools is technologically behind the times” (Summary, point 1).

Some schools had bookable computer rooms whilst others had not. In some schools IT and other subjects seemed to have a monopoly on facilities. The degree to which teachers claimed access to computer rooms did not appear to be influenced by the numbers of computer rooms in their schools. The generality seemed that schools with the greatest number of computer rooms were those that had gained external funding. In general, informants spoke of poorer access to computer rooms than they would have wished. This conflicts with Oliver’s (1994) belief that “equipment levels within schools are rising to the point where access is no longer an issue” (p. 140) but accords with other studies (Zammitt, 1992; Blackmore, 1992; Downes, 1993; Williams & Moss, 1993) although the latter comment that such perceptions may be a consequence of “an inherent tendency for staff ... to believe that things are better elsewhere” (p. 83). It is of interest that several teachers alluded to a belief that problems of access are not always a consequence of disparate funding but may be more concerned with managerial inadequacies – a continuing problem noted by school inspectors (Goldstein, 1997).

An interesting perception was that those teachers who claimed access to computer facilities seemed to be those who had tried to gain it. This accorded with the ImpacT study (Watson, 1993) which found that “it was the keen IT user who managed, in spite of the many difficulties encountered, to obtain access to IT resources, whilst others accepted the status quo”
(p. 16). Alternatively, teachers who claimed little or no access seemed to be the ones who had never seriously tried to gain it. This was supported by the comments of one teacher who claimed no bookable access to any of his school’s three computer rooms whilst simultaneously suggesting that he was too busy to explore the possibilities and was grateful for the technology department’s delivering the IT curriculum. The evidence here lends some support to a finding of Zammit (1992) and Brummelhuis & Plomp (1993) that teachers frequently use perceptions of poor access as an excuse for not trying.

Also, in accord with the finding of Pelgrum & Schipper (1993) and irrespective of the quality of provision, there were teachers unsure as to why the teaching of mathematics should entail the use of computer rooms. One explanation might be that the curricular integration of computers in their respective schools was less complete than in others. The Comped study found, for example, that ‘the degree of integration of computers seems to covary with the emphasis put on educational reasons for introducing computers’ (Pelgrum & Schipper, 1993, p. 146).

The disparity between the ratio of pupils to computer rooms of different schools identified seemed greater than those reported elsewhere (Williams & Moss, 1993; Yeomans et al, 1995). The worst ratio of more than 1200 brought into question that school’s ability to deliver the English National Curriculum. In such schools few teachers could exploit computers for anything other than perfunctory experiences. It is conjectured that such a provision may have a more lasting negative effect than would a provision of zero computers. Irregular and cursory computer use may precipitate the dissatisfaction and negative attitudes likely to dissuade teachers from further use. Zero availability, though likely to foster frustration, would be unlikely to contribute to negative attitudes and poor pedagogic practices. The best ratio was below 200 and a consequence of a successful bid for additional technology funds. However, despite the propitious circumstances the mathematics teacher interviewed seemed uncertain, beyond the use of a sophisticated tutorial package, how best the facilities might be used. Such situations, whereby the arrival of computers was faster than the rate by which teachers could assimilate them meaningfully into their work, were observed some years ago (Stasz & Shavelson, 1985) and appear no better resolved ten years later.

A few teachers spoke with enthusiasm about the use of single computers in their room, although, in general, such facilities were viewed with scepticism. Few had difficulty in obtaining one but most saw little point in so doing. It was inferred, due to complaints that such machines were old and incompatible with machines elsewhere in the school, that such computers tended to be BBCs. Such scepticism accords with the findings of Yeomans
et al (1995) that by the mid 1980s “the country’s ubiquitous BBC computer with its Basic language, was at best irrelevant and at worst counterproductive.” (p. 330).

Most frequently single computers were used as part of a carousel of activities which some teachers viewed positively and others not. Underpinning many responses seemed to be a belief that successful computer use necessitated children’s operating the keyboard. This perception was supported by those who complained that, with single machines in a classroom, children receive inadequate hands-on experience. There was little sense, for example, that teachers were aware that a single computer could provide a focus for a whole class discussion, with its concomitant redefinition of classroom relationships and pedagogies, as described optimistically some years ago by Phillips (1986) and Dunn (1986). It is possible, as a consequence of National Curriculum and school policy ambiguities, that many teachers, uncertain as to the purpose of computer use, perceive their role as supporting children’s acquisition of IT skills rather than using computers to enhance mathematics. Such ambiguities are not uncommon: “one problem often associated with program guidelines is that they suffer from vagueness, often reflecting compromises between parties involved” (Pelgrum & Plomp, 1993b, p. 324). Also, when objectives for an innovation lack clarity they may result in piecemeal implementation and anxiety and frustration for those responsible for its management (Fullan & Stiegelbauer, 1991). There may be other reasons for teachers’ reactions to BBC machines. The evidence above suggests that older machines are perceived as technically demanding which accords with the comments of Anderson & Collis (1993) that computers of the early 1980s were such that ‘one often had to write a program in Basic, Fortran or Pascal to accomplish a computer related task’. When the power is switched on the only outcome is a blank screen with a Basic prompt. The only options are to program in Basic or load a program from a floppy disk. Frequently teachers experience problems with machines not doing what is expected of them. Printing from them is perceived as difficult. In such contexts teachers may be dissuaded by the expectation of their having to make technical rather than pedagogic interventions. Other teachers, for a variety of reasons, may have become familiar with machines with sophisticated graphical user interfaces. They may be competent users of software which requires little more than the skill of pointing and clicking a mouse and expect no difficulties in printing or saving their work. Such people may be reluctant to engage with machines which require skills outside their repertoire. Alternatively, a teacher experienced with BBC machines and the booting of simple programs from a floppy disk, might balk at the use of more sophisticated software and its mass of tools and menus.
Whether the above reflects the true state of computer provision in schools is not necessarily the important issue. Teachers believe they have inadequate access to resources. This is a problem because “if teachers do not believe that facilities are available or they feel that they are being obstructed in their desire to gain access … then they will not be used” (Andrews, 1995, p. 96). Further, the machines to which many teachers have access are old and, in respect of the expectations laid upon them, inappropriate (Stevenson, 1997).

Implications

There are implications for school managers. The evidence of this study indicates that most computer rooms have insufficient machines for all children to work alone and that paired working, planned or otherwise, seems to be the norm. The evidence also suggests that any benefits pupils gain from such working is more likely to be coincidental than planned (Eraut & Hoyles, 1989). Consequently, and in the light of substantial evidence indicating that children who work at computers in groups benefit, both intellectually and socially, in many ways (Cox & Berger, 1985; Johnson et al., 1985; Guntermann & Tovar, 1987; Rysavy & Sales, 1991; Mevarech et al., 1991; Sutton, 1991; Hoyles et al., 1991; Hooper, 1992a, 1992b; Hoyles et al., 1994; Jackson & Kutnick, 1996). It is conjectured that any computer room in which there are sufficient machines for children to work alone contains too many computers. Those schools may be better served by placing sufficient machines in each computer suite to force groupwork. In most circumstances this would mean no more than 15 computers in any one room. Schools in which computer rooms have more than 15 machines might be better served by considering ways in which the excess might be redeployed.

The interviews suggested that many teachers are sceptical of the value of single computers in their classrooms. They tended to use them as part of a carousel of activities, with little sense of their being part of a coherently structured learning experience. Frequently they were used as a reward which emphasised rather than ameliorated the differences between children – a use criticised by English school inspectors (Goldstein, 1995). Also, such use encourages teachers to neglect the pedagogic decisions necessary for software to be deployed effectively (Katterns & Haigh, 1986). It is suggested that such machines form the basis of additional computer rooms. It is acknowledged that many of these machines are likely to be the BBCs which many informants described as inadequate, although it is conjectured that such a computer room is likely to be more useful than 15 machines distributed around a school. In this way it is not inconceivable that schools currently with two computer rooms and a bevy of stand-alones might equip four.
The evidence indicates that many of the issues addressed in earlier research have not been resolved. Many teachers remain ambivalent, possibly phobic, towards computers and that this is a significant source of inertia (Somekh & Davies, 1991). The computer remains an innovation and is perceived to de-skill people and create incompetence (Heywood & Norman, 1988). Somekh (1992) notes, in particular, that “... new technology constitutes an attack upon the self-image and professional values of some individuals, because ... computers may suggest an inhuman influence in the classroom and seem to promote pupil isolation” (p. 157).

It is suggested, therefore, that managers consider arranging their computer rooms in ways which allow teachers to address the whole class simultaneously whilst seeing their pupils’ faces. In most computer rooms teachers are forced to speak to a sea of backs (pupils and/or computer monitors) which creates unwanted and unnecessary challenges to established and successful classroom management skills.

There are other pedagogic considerations. Teachers, aware that computers should enhance, and not dictate, the manner in which teaching and learning take place, may wish to work in ways which encourage pupils to see computers as tools which support learning and not as ends in themselves. Such a perspective appears at odds with the English National Curriculum expectations described above. Teachers may wish their children to work in pairs or on their own. They may prefer their pupils to work on different tasks. They may want them to change activities half-way through a lesson. The possibilities are many. Such diversity, however, necessitates a review of the layout of the computer room. Space needs to be created for learners to work, in conventional pen and paper manner, away from the computers themselves. Such approaches, despite being grounded in the experiences of teachers of mathematics are believed to be valid for teachers of other subjects. Teachers of English, for example, may wish to discuss with a whole class an essay which is to be written. The outline plan of the essay is constructed away from the computer but the draft is then written on a word-processor, printed and then edited away from the machine.

There are implications for teacher education and, in particular, initial teacher training. Most British secondary teachers enter the profession having followed a one year post graduate certificate in education course (PGCE). Such courses, since 1994 (DfE, 1992), comprise twenty-four weeks school-based and just twelve weeks college-based training. The evidence of this study suggests that relatively few teachers of mathematics are likely to have the access to computers, and importantly, the skills and expertise necessary for them to act as mentors to initial teacher trainees. Consequently, school-based experiences are unlikely to lead to the fulfilment of the Teacher Training Agency’s (TTA, 1997) requirements in respect of beginning teachers’ IT
competence. Such concerns are not new (Monaghan, 1993; Andrews, 1995, 1997) but appear unlikely to be resolved within the context of school-based experiences. Those responsible for the design and implementation of initial teacher training courses may have to consider ways of using the limited time in college to re-mediate this situation.

In summary, the findings of this small scale study indicate that teachers of mathematics claim poorer access to computers than curriculum documents might have expected although there is evidence that such claims may mask other problems – not least the ageing population of machines to which most appear to have access. Computer rooms with modern machines appear less readily available than old stand-alone machines although there is some evidence that those who seek access are usually successful in gaining it. Many teachers are sceptical of single computers and uncertain as to how they might be used effectively. A way forward, in which computers might be deployed more productively, has been proposed.

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References


NCC (1990) *Technology: non statutory guidance for information technology*. York: NCC.


Teacher Training Agency (1997) Standards for the Award of Qualified Teacher Status. London: TTA.


