Chapter 4

Factors affecting teachers’ use of computers in the school (Phase 1)

While evaluating the software package at the beginning of the study, it became evident that the quality of the software was not the only factor in the case study school affecting whether teachers were using the software package. This led me to investigate how teachers were using ICT, in general, at the school. During the first phase of the study only five teachers (including myself) were using computers for teaching purposes. In this chapter I present qualitative data, from interviews with the four teachers and my researcher’s log, on the factors which impacted on their use of ICT, before the Digital School Project was introduced at the school, in an effort to answer Research Question 1 (see below). Research Question 1.1 is further addressed in Chapter 5, which deals with the evaluation of the EduRom software package.

<table>
<thead>
<tr>
<th>Research question 1: What factors affected teachers’ use of information and communication technology at a case study school?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 To what extent did the suitability of available software affect teachers use technology?</td>
</tr>
<tr>
<td>1.2 What other factors affected teachers’ use of technology?</td>
</tr>
</tbody>
</table>

4.1 OVERVIEW OF FACTORS AFFECTING TEACHERS’ USE OF COMPUTERS

The analysis of the transcripts from the interviews, and my researcher’s log, revealed 21 factors affecting how the five teachers were using computers in the school. I included myself in the sample because, at the time, I was a teacher at the school and wires attempting to integrate technology into my teaching. This made me a participant-observer. Figure 26 (on the next page) is a concept map representing how I grouped these 21 factors into categories and subcategories. I have labelled the resulting four categories of factors A, B, C and D, to make it easier for readers to orientate themselves when the different categories of factors are discussed later in this chapter, and have added numbers to the letter for each category to indicate the subcategories. For example, the two subcategories of hardware-related factors (A) are ‘inadequate provision of hardware’ (A1), and ‘technical problems’ (A2). Finally, the factors making up each subcategory are given in the square text-boxes towards the outside of the concept map in Figure 26.

Using the categorisation proposed by Ertmer (1999) (see Chapter 2, page 34), I have classified, using colour coding in the figure, the categories of factors affecting teachers’ use of computers into ‘external’ barriers to ICT integration (shown in green) or as ‘internal’ barriers (shown in brown). External barriers are factors relating to the provision of resources by the institution and are beyond teachers’ control. Three of the four categories of factors which emerged from the study qualify as external factors: the hardware-related factors, software-related factors, and institutional factors within the school (see Figure 26). The fourth category of factors originates within teachers, and is thus classified as a group of internal factors affecting teachers’ use of computers. The external and internal factors which emerged during the study as affecting teachers’ use of ICT, are discussed after Figure 26.
Figure 26. Concept map summarising the factors affecting how teachers use computers for teaching and learning at the school.
4.2 EXTERNAL FACTORS AFFECTING HOW TEACHERS USE COMPUTERS

A: Hardware-related problems

The five teachers who were attempting to use computers for teaching revealed the hardware-related factors summarised in Table 7 as factors which affected their computer use. Ten of the 12 factors mentioned in Table 7 were barriers the teachers perceived as hindering their use of computers [see factors marked with (-) in the table].

Table 7. The hardware-related factors teachers said affected their use of computers in the school

<table>
<thead>
<tr>
<th>Sub-category</th>
<th>Factor</th>
<th>Teachers</th>
<th>Frequency count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1: Inadequate provision of hardware</td>
<td>Insufficient computers provided for number of learners per class (prior to purchase of new computers). (-)</td>
<td>T4⁹</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sufficient computers for number of learners (post-purchase of new computers). (+)</td>
<td>T1, T2, R</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Only one SMART Board (which must be booked) for whole college. (-)</td>
<td>T1, R</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Sufficient computers for staff use (post-purchase of new computers). (+)</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Insufficient computers for staff use (post-purchase of new computers). (-)</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Lack of computers in the classroom. (-)</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Teacher does not have a digital camera in the classroom. (-)</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>A2: Technical problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Problems with computers not working properly. (–)</td>
<td>T2, T4, R</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Problems with the connection to the server. (–)</td>
<td>T2, T4, R</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Problems with Internet connection. (–)</td>
<td>T2, T4, R</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Problems with printers not working properly. (–)</td>
<td>T2, R</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Frequent power failures. (–)</td>
<td>R</td>
<td>1</td>
</tr>
</tbody>
</table>

R = researcher, a fifth teacher in the study, but a participant-observer
(-) perceived barriers to teachers' use of computers; (+) factors which encouraged teachers' use of computers

A1: The inadequate provision of hardware by the school

Problems relating to computer hardware are well-documented in the literature as having a significant negative impact on teachers' use of computers (see Chapter 2, pages 35-37). The provision of hardware is a fundamental requirement for teachers wanting to use technology for teaching and learning.

Table 8 (on the next page) is a summary of the facilities available to teachers at the school during the early stages of the study (Year 1 to Year 2), while Figure 27 (also on the next page) shows how the hardware and software facilities changed during the course of Year 1¹⁰.

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⁹ In this chapter, teachers involved in this study are identified by ‘T’ followed by a number. This is being done for ease of reporting data, especially in tables, in this chapter. In later chapters, notably Chapter 7, I will use the word ‘Teacher’, followed by a number.

¹⁰ The South African academic year runs from January to December.
Table 8. Facilities available to teachers wanting to use computers in their lessons (Year 1 to Year 2)

<table>
<thead>
<tr>
<th>Facility</th>
<th>Staffroom</th>
<th>Media centre (resource machines) *</th>
<th>SMART Board room</th>
<th>Classrooms</th>
<th>Computer laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>hardware</td>
<td>connected to server ✓</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>number of computers</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td>SMART board</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>software</td>
<td>Microsoft Office ✓</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Internet ✓</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>software encyclopedias x</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>✓</td>
</tr>
</tbody>
</table>

* Available to learners wanting to use facilities outside of lessons (during breaks and after school)

Figure 27. Timeline showing changes in resources during the first phase of the study

The facilities available at the school in Year 1 to Year 2 (as listed in Table 8 and mentioned in Figure 27) provided the following options for teachers wanting to use computers in their teaching:

- They could book the SMART Board room and take their class there for a lesson using the SMART Board.
- They could book the computer lab and take their class there for a lesson using the computers.
- They could book the school laptop and data projector for a lesson, providing they had a projection screen in their classroom.

Despite having these options available to them, only five (including myself, the researcher), of 15\(^{11}\) teachers were attempting to integrate technology into their teaching in Year 1. When interviewed, the four other teachers reported limited use of the facilities, as shown in Table 9, on the next page.

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\(^{11}\) The 15 teachers comprised the teaching staff at the secondary-level college during Year 1 of the study. The small number of teachers during the first phase is due to the college having started up two years before the study began and only having four grades (8, 9, 10, and 11) in Year 1.
Table 9. The extent of use of the computer facilities by teachers in the study

<table>
<thead>
<tr>
<th>Facility</th>
<th>Teacher 1</th>
<th>Teacher 2</th>
<th>Teacher 3</th>
<th>Teacher 4</th>
<th>Researcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer lab</td>
<td>Once a term</td>
<td>Once a month</td>
<td>No information on use available</td>
<td>Daily*</td>
<td>Once a week (on average)</td>
</tr>
<tr>
<td>SMART Board</td>
<td>One lesson for the year</td>
<td>One lesson for the year</td>
<td>Twice for the software package**</td>
<td>No information on use available</td>
<td>Once a week (on average)</td>
</tr>
</tbody>
</table>

* This is a computer teacher, who would have been teaching in the computer lab every day.
** This is a science teacher, who used the physics module of the software package.

Besides Teacher 4, who taught Computer Science in the computer lab, usage of the computer lab ranged from once a week to only once a term. Two of the teachers only used the SMART Board for one lesson for the year.

The inadequate provision of hardware was identified as a problem preventing teachers from using computer technology in the school, especially in the early part of Year 1. The teachers in the study identified the following problems with the provision of hardware:

- **Insufficient machines in the computer laboratory before March, Year 1:** Before the purchase of the new computers in March of Year 1, there were only two computers in the computer lab (see the timeline in Figure 27, on previous page). This number of computers was insufficient for a whole class, but this was not clearly communicated to all teachers. I thought that there were sufficient computers in the computer lab, but that they were not working due to technical problems. During my interview with her in October, Year 1, the computer teacher (Teacher 4) explained that financial constraints were the reason why there had been insufficient computers in the computer lab prior to March of Year 1:

  "We only purchased our machines straight after the half-term break. So, the machines were really ready from March onwards. I wasn’t allowed to – from a budget point of view – buy them before." (Teacher 4)

The lack of computers in the early part of Year 1 impacted negatively on my teaching because I could not set work which required learners to use computers. I recorded the following entry in my log:

  I tried to explain to T4 that I was told that the computers would be up and running by the end of January (This is what T5 had said). She wanted to know who had said that, because it was highly unlikely that was ever going to happen. She said that it was unlikely we would have any computers before mid-term [last weekend of February, Year 1]. It appears that we have been misled about when the computers will be ready. T5 first said the end of January, then two weeks later. It is now nearly mid-term and still there are no computers available! (Researcher’s log, 22 February, Year 1)

After the purchase of the 24 new computers in March, Year 1, three of the five teachers involved in the study felt that there were now sufficient computers in the computer lab to accommodate the numbers of learners in their classes (the school policy was that the number of learners in a class should never exceed 25). Teacher 2 commented that she felt that there was "no problem with the number of computers". The other teacher (Teacher 1) felt that there were sufficient computers, explaining: "I don’t have one class that’s 25. So … at this stage – absolutely fine". I, however, found that although there were sufficient computers, the space in the lab was insufficient to comfortably accommodate a class of learners, as I recorded in my log:
I crammed 20 Grade 11s into the computer room. While there are supposed to be sufficient computers for a class of 25, the space is limited so it does tend to be a bit of a squash.
(Researcher's log, 18 October, Year 1)

- **Insufficient computers in the staff room for teachers to use.** Only two teachers commented on the number of computers in the staffroom. Teacher 1 felt that there were sufficient computers, but I felt that there weren't. Teacher 1's perception of there being sufficient computers may have been because of limited extent of her usage of the staff computers. She may not have had to wait to use a machine. At the end of the first term of Year 1 there were four staffroom computers that were being shared by the staff of both the preparatory school (n = 32) and the college (n = 15)\(^\text{12}\). This meant that there were often long queues for the machines, especially towards the end of term when marks and comments for reports had to be entered. The situation eased somewhat when two more computers were purchased for the staffroom in March of Year 1, but I thought there still weren't sufficient computers. Many teachers resorted to bringing in and using their own laptops to enter their marks and comments. I eventually purchased a laptop (see the timeline on page 98) in an attempt to make it easier for me to enter my marks and comments. I had tried processing my marks in a spreadsheet at home, which I would then email to school and transfer to Pencilbox\(^\text{13}\) but because of technical hitches this was not always a simple matter. I described my reasons for buying a laptop in the following entry in my log:

> I decided to buy a laptop to avoid the problems associated with the school machines round about this time. Both the preparatory school and college staff have to enter marks and comments onto Pencilbox, with the only machines available the six in the staffroom and the four machines in the media centre. That's a total of 10 machines for perhaps 40 staff members (preparatory school and college). Working at home and emailing marks and comments is not reliable, because there are often problems with emails being delayed, phone lines being down, or the server not working. (Researcher's log, 18 November, Year 1)

Purchasing a laptop alleviated my immediate problem, but even with some teachers using their own laptops, there still weren't sufficient computers available for teachers to use:

> I've definitely made my life easier by buying the laptop. Lots of teachers are very stressed as they wait for machines to be free so they can use them. Only three or four of us have laptops, and we often sit in the staffroom, close to the power points (of which there are three), with our laptops on one of the coffee tables or perched on our laps, while we enter marks or comments. (Researcher's log, 24 November, Year 1)

- **Limited availability of the SMART Board in the college and the fact that it had to be booked.** At the strategic planning meeting held in October, Year 1 it emerged that

> ...teachers felt that the SMART Board could be used more and could be used more effectively. (Researcher's log, 22 October, Year 1)

Teacher 1 and I both felt the limited availability of the SMART Board was a problem. One of the reasons why its availability was limited was because Teacher 3 was teaching in the room which housed the SMART Board. This meant he had to find another venue for his class whenever someone wanted to use the SMART Board while he was supposed to be teaching in that room. The following extract from my log illustrates the complicated process of arranging to use the SMART Board room:

---

\(^{12}\) The lower number of teachers in the college was due to the college not having all grades in Year 1 of the study. The first class of Grade 12s was introduced in the college in the second year of the study. The number of teachers in the college increased over the course of the study as more teachers were employed to accommodate growing numbers of learners.

\(^{13}\) *Pencilbox* is a package used to enter marks and comments and produce learner reports.
I booked the SMART Board room with T4 for the Grade 11s. I want to try out the enzyme animations on the SMART Board. I also checked with T4 that the Internet is up and running in the SMART Board. She says it should be fine as Tech1 was supposed to have fixed it all up some time ago. There were no problems with making the bookings. After checking that each of the rooms was available when I needed it T4 wrote it all down on a piece of paper on her desk which she pinned up on the notice board adjacent to her desk. T3 will have to swap with me for two of the Grade 11 lessons, since he teaches in the SMART Board room.

(Researcher’s log, 11 October, Year 1)

At this stage it is worth noting that the booking system used by Teacher 4 (as described in the extract immediately above) was somewhat inefficient. The problems with the booking system are discussed later.

- **No computer hardware and supporting technology in the classrooms.** During the interview with Teacher 1 she mentioned that she would have liked to have had a computer in her classroom, as well as a digital camera. She discusses what she would have done with these pieces of equipment in the following extract from our interview:

  ... you know what? I’d love something like ... I’d love a digital camera in my top drawer and then when a child’s finished a project, then they can take a photograph of three different views and use it for ... like ... their isometric drawing, for the cover page of their portfolio. Because some of those projects you can’t send up, but I’d like them to have access to it and incorporate it into their presentations. I’d like to have a computer in my classroom connected to the Internet so we could quickly just look up something if we need to look up something quickly. (Teacher 1)

The lack of computers and limited availability of the SMART Board room impacted negatively on how teachers were able to incorporate computer technology into their teaching during Year 1. Findings from other studies suggest that a lack of funds to purchase resources is often a factor limiting teachers’ use of ICT (see Bauer & Kenton, 2005; Donnelly et al., 2011; Ertmer et al., 2012). In one study a lack of finances to buy the equipment required by the 12 ICT award-winning teachers was identified as the fourth most significant barrier to using technology for instruction (Ertmer et al., 2012).

### A2: Technical problems

Two serious technical problems resulted in the computers being unavailable to college staff and learners for a significant part of the first term in Year 1 of the study.

- A lightning strike in early January damaged most of the school computers. I recorded the following entry in my log about the computers not being available

  ... returned to school to find computers have been struck by lightning. No computers, even in the staffroom. (Researcher’s log, 12 January, Year 1)

  Repairs to the computers were completed only by the end of January, Year 1.

- Other technical problems. Shortly after the computers were repaired other technical problems arose and the server was down until the beginning of March.

These technical problems meant that teachers could not use computer technology in their teaching for most of the first term. On 22 February I recorded in my log that I was feeling “very frustrated” at the fact that it was “almost mid-term [of the first term: last weekend of February, Year 1] and “still no computers” were available for either staff or learners to use. The technical problems experienced in early Year 1 impacted strongly on another teacher, Teacher 2, who needed to use computers for her
Grade 9 classes to carry out the Common Task Assessment (CTA) for that year. CTA’s are set by the Independent Examinations Board for each subject in Grade 9. The tasks have to be completed by a specific date and the marks submitted to the Independent Examinations Board. In our interview, she made the following comments about the technical problems she had experienced during the first term, which had delayed her starting her CTA.

... I shouldn’t say I don’t like computers, but there always seems to be some kind of technical problem. I know we’ve had them, because of where we are and lightening and service providers.

... we’ve had a lot of problems this year. I mean, for me, the first term was written off in terms of using the computer centre. (Teacher 2)

Besides the computers not working and the problems with connecting to the server, other technical difficulties affected teachers’ use of computers:

- **Problems with connecting to the Internet.** The following extract from my log illustrates the difficulty I experienced when I was not able to connect to the Internet during one lesson.

  I took the Grade 11s to the SMART Board room today for a double lesson. What a disaster!
  I couldn’t connect to the Internet: no icons appeared when Windows opened.
  I also spoke to Tech1 about my experience. He said that the Internet wasn’t accessible because they were experiencing problems with the server. According to him it should be okay tomorrow. I’m confused, to say the least. Internet or no Internet? (Researcher’s log, 17 October, Year 1)

Teacher 2 had the following to say about the problems she had experienced with using the Internet during lessons in the computer lab:

... often I find that when I go there the Internet is not up and running, so I have a problem with actually getting onto the Internet, and I find it a waste of my time and then we come back to class and we’ve wasted 10 minutes ... often the Internet is not up and running or it’s very, very slow. (Teacher 2)

The following extract from my log highlights how the delays caused by not being able to connect to the Internet caused Teacher 2 to fall behind with her CTA.

T2 came to my lab in the first lesson to plead with me to allow her to use the computer room for the second and third lessons, even though I had booked it. She said that problems connecting to the Internet had delayed her and that she’s absolutely desperate to finish her CTAs, so I agreed. This meant I could only use it for one of my double lessons today. I’ll have to book more lessons for next week or my kids won’t have had enough time. (Researcher’s log, 28 October, Year 1)

Teacher 2 continued to experience problems trying to complete her CTAs. I witnessed one lesson in which she was experiencing difficulties with connecting to the Internet. Her class was trying to use a particular search engine, but they could not connect to the Internet. I recorded the following entry in my log after this incident:

When I went in to confirm my bookings for the computer room and to book the SMART Board room, I found T2 in there looking very stressed. Apparently her class was having difficulty connecting to the Internet. T4 was sitting at her desk, taking no notice of the situation unfolding around her. T2 looked so flustered that eventually I went to help one group. On the staffroom computers, when the home page opens, it often says ‘can’t find server’, but if you type in another website, it opens it. I tried this with Ananzi14 and it worked. It seems that trying to open ‘google.co.za’ is what gives the error message. The other groups tried it and it worked fine. (Researcher’s log, 31 October, Year 1)

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14 Ananzi is a search engine.
Connectivity problems have also been cited by some teachers in other studies as a factor which discourages the use of computers in lessons (e.g. Bauer & Kenton, 2005; Ertmer et al., 2010).

- **Problems with printers not working properly.** The following extract from my log highlights the manner in which the inability to connect to a printer made it difficult for one of my classes to complete a task I had set for them.

  ... *they couldn’t print because there isn’t a working printer available in the computer room.*
  (Researcher’s log, 28 October, Year 1)

Teacher 2 also mentioned that she had experienced difficulties during lessons when the “printers are not connected” in the computer room, which made her reluctant to use computers in her teaching because

  ... *I’d rather, then, be in class – I don’t have 10 minutes to lose in class time.* (Teacher 2)

- **Frequent power failures.** The school frequently experienced power failures. Some of these were scheduled shut-downs about which the school received warnings, so teachers knew not to plan lessons using any electrical equipment. Some of the power failures were not, however, scheduled and sometimes made it impossible for me to conduct lessons involving computer technology. I recorded the following entries in my log regarding the impact of unscheduled power failures on two lessons in which I had planned to use the SMART Board and the data projector, respectively:

  We had a power failure today shortly before I was due to go in and finish off the presentations with 9A. The power failure lasted for about an hour, so the lesson was completely scuppered. We revised some stuff in my lab instead. (Researcher’s log, 11 November, Year 1)

  I had planned to use the projector with the Grade 12s, but the electricity is down throughout the school. The only computer working is the one in the front office in Reception, which runs on a generator. (Researcher’s log, 5 July, Year 2)

Technical problems have been identified in other studies (e.g. Butler & Sellborn, 2002; Hossain & Brooks, 2008) as discouraging teachers’ use of computers for teaching.

**B: Software-related problems**

Three categories of software provision – the availability of instructional software, the quality of the software available, and the ease-of-use of the software provided – were identified from the 48 studies I reviewed in Chapter 2 (see page 37). Although problems with all three categories of software provision emerged during this study, the problems relating to the quality and ease-of-use of the *EduRom* software evaluated in this study (which are detailed in Chapter 5) have been grouped together and separated from more general issues surrounding the provision of software in the school.

**B1: Issues related to the *EduRom* package**

Towards the end of the year prior to the study (see Figure 27 on page 98), the school bought a software package (from which topics of the biology module were evaluated as part of this study). *Information Box 1*, on the next page, provides some information about the purchasing of the package. There was great excitement in the science department when it was announced that software had
been purchased for teachers to use. I was particularly keen to start using the software early in Year 1, based on comments made by the Deputy Head (T 5) when he informed me that the software was going to be bought. I recorded the following in my log, in mid-November of the pre-study year: "He also said that the software had really good animations and that he and T6 had taken a look at the software and were really impressed with it".

Some of the claims made by the software designers, which prompted me to evaluate parts of the biology module as part of the research study (see Chapter 5), are given in Information Box 2.

**Information Box 1**
The software package purchased in November 2004 consisted of four modules: Biology, Chemistry, Physics and Mathematics. At this time the software was available for a limited period at a special price of R595 per module (compared to the normal selling price of R1995 per module). The purchase was made when final examinations were being written. The science and biology teachers who would be using the software were not consulted about the choice of software before it was purchased. The teachers were directed to a website where they could sample the package, but no feedback was requested. This meant that there was no input from teachers likely to use the package as to whether or not the package was suitable, and likely to meet their needs. The decision to purchase the software was made by the School Executive.

**Information Box 2**
Among the claims made by the distributors of the package purchased by the school, which I later evaluated, the following relate to the South African curriculum being implemented in Year 1:
- "(The software) provides the answer to the latest curriculum"
- "(The software) provides the answer to continuous evaluation"
- "(The software) provides interactive educational software, covering the majority of the new curriculum, based on OBE and e-learning principles."

Teacher 3 and I, as the only two teachers in the school who actually used the software package, encountered a wide range of problems with it. After an initial review of the biology module of the software for use in my own teaching, I recorded in my log "Don't know how I'm going to include this in my lessons!" Ultimately, the shortcomings Teacher 3 and I perceived with the software contributed to neither of us using it after initially trying it out. We encountered many similar problems with the software (see Table 10, on the next page), although he had used the physics and chemistry modules. The problems we encountered fell into three main categories, as discussed below.

**Teachers were not consulted before the software was purchased**
As mentioned in Information Box 1 (see page 98), the package was purchased during a very busy period of the school year, so none of the science or biology teachers, besides the teacher involved in making the purchase (Teacher 5), actually viewed it before it was bought. Although Teacher 5 refers to Teacher 6 being 'impressed' with the software, Teacher 6 is a member the Executive Committee of the school and is not a science teacher. His input on the usefulness of the software as a tool for teaching science would thus be limited.
Table 10. Issues relating to the software package

<table>
<thead>
<tr>
<th>Problem</th>
<th>Sub-problem</th>
<th>Teachers</th>
<th>Frequency count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software unsuitable based on factors relating to content</td>
<td>Content not based on South African curriculum.</td>
<td>T3, R</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Content not detailed enough.</td>
<td>T3, R</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Assessments covered only lower-order skills.</td>
<td>T3, R</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Experiments shown in package uninteresting.</td>
<td>T3,</td>
<td>1</td>
</tr>
<tr>
<td>Software unsuitable based on factors relating to design</td>
<td>Content presented as if package is an ‘electronic textbook’.</td>
<td>T3, R</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Limited interactivity (mostly clicking on links to different pages).</td>
<td>T3, R</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Images too small.</td>
<td>T3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Insufficient emphasis on skills.</td>
<td>T3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Software more suitable as a reference tool than teaching and learning tool.</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Difficult to navigate through package.</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Appears to have been designed by the programmers, not educationalists.</td>
<td>T3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Design not suitable for SMART Board use; better suited to a computer lab.</td>
<td>T3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Content not arranged in lessons.</td>
<td>R</td>
<td>1</td>
</tr>
</tbody>
</table>

Bookmarking of content to be included in lessons would be time-consuming for teachers. T3, R 2

Problems relating to the content

Although marketed as suitable for the new curriculum being implemented in South Africa (see claims made by software designers in Information Box 2), Teacher 3 and I found the following content-related issues rendered the software unsuitable for our use:

- **The content does not match the South African curriculum.** Ideally, teachers should choose software which fits into their curriculum. In this study, both Teacher 3 and I found it difficult to reconcile the software content with the stipulations of the new South African curriculum. A similar problem was reported by one of the five chemistry teachers in the Irish study conducted by Donnelly, McGarr, and O’Reilly (2011). The teacher in the study was frustrated by the types of assessments in one software package not being aligned to the Irish curriculum.

When Teacher 3 and I met with the managing director of the company who had supplied the software (Mr C), he revealed that the package had not actually been developed for the South African curriculum (in spite of their marketing claims to the contrary). The meeting with Mr C provided some insight into what Teacher 3 and I perceived to be the software’s shortcomings.

T3 also commented on being displeased at the content covered in the physics and chemistry modules that he had now spent some time looking at. Mr C explained that the software is based on the European, specifically the Polish, curriculum. (Researchers’ log, 1 June, Year 1)

After becoming aware that Teacher 3 had used the physics and chemistry modules of the software, I was interested to hear more about his experiences with it. In my later interview with Teacher 3, he made the following comments about how he felt the software content related to the science curriculum:

... and it was very disappointing from a number of aspects. The one aspect was that it didn’t follow the syllabus. These discs – I mean you’ll know this better – I don’t know where they were produced. They come out of Sweden or … you said out of Poland? Okay, so, I’m assuming that they were more tailored to their syllabus but it was not tailored to the South African syllabus ... and then, of course, there are a number of sections that are not covered
at all. And then obviously ... you know ... there are sections that are covered that we don’t touch on. (Teacher 3)

I recorded the following entry about the events immediately after the second meeting with Mr C:

I spoke to T3 afterwards in his office about the quality of the software. He says that based on what he has seen, the software should never have been bought. He doesn’t think the software is truly interactive nor is it good enough to base lessons on. This was something he had raised with Mr C – there is no distinction between content suitable for the different levels (GET vs. FET). Mr C’s suggestion that the teacher should bookmark relevant content for inclusion in a lesson would be time-consuming. (Researcher’s log, 1 June, Year 1)

- **Assessments covered only lower-order skills.** Teacher 3 said he thought that the assessments included in the software only covered lower-order skills. He described the assessments he had seen as “completely pathetic”. He related the poor quality of the assessments to the limited use of interactivity in the software:

  ... and I think a lot of that [the poor quality of the assessments] was brought on by the lack of functionality of that interaction [the limited use of interactivity in the software]. So they [the software designers] couldn’t ask any decent kind of question, because ... you know ...

  "What is one plus one? Two." And that was the sort of thing. (Teacher 3)

My initial opinion of the assessments used in the biology module (prior to evaluating the software package, as presented in Chapter 5) is summed up in the following entry in my log: “a total of 3 content-based questions form the assessment at the end of one section”.

- **Experiments shown in package uninteresting.** In addition to the poor quality of the assessments, Teacher 3 also found the experiments in the software to be unsuitable for use in his teaching:

  ... to actually have it with the kids ... to run through it with the kids in a SMART Board room, where ... you know ... the experiments are minute, because it’s on a SMART Board screen ... but within that screen, the experiment often is not taking up the entire screen. It’s a window\textsuperscript{15} within it. And you know, the experiments were mostly boring little experiments. You know ... doing experiments where they’re putting different chemicals into water to see if they fizz or bubble. And you’re seeing this on a TV screen ... it’s absolutely pathetic ... yeah ... and also ... I think ... with things like the experiments, it was quite clear that it was being translated into a number of languages because the person doing the experiment would not talk at all. They would kind of like have this deadpan face and doing the experiments while there was a voice-over. And to me it just didn’t engage the kids in any way. (Teacher 3)

Teacher 3 went on to describe what sort of experiments he would have found useful:

... for example ... you know ... if the experiments were exciting. For experiments that one does not do in the classroom because maybe they’re too expensive or you don’t have the apparatus. That sort of thing I would’ve gone through and I would’ve bookmarked ... but the experiments weren’t exciting. (Teacher 3)

**Problems relating to the software design**

Interactivity is believed to foster deep learning by engaging learners in the learning process (Evans & Gibbons, 2007). Kennewell, Tanner, Jones and Beauchamp (2007) emphasise that software design is an important factor influencing interactivity. Teacher 3 and I identified a number of problems relating to the software design, many of which could be related to the lack of interactivity in the software.

- **Lack of interactivity.** Both Teacher 3 and I found that our initial assessments of the suitability of the package suggested an inadequate level of interactivity. The emphasis on content did not meet what Teacher 3 appeared to be looking for in a multimedia package.

\textsuperscript{15} Teacher 3 is referring to an overlay which opens on the screen. The overlay shows a television screen, on which the experiment is then displayed.
... I certainly don't need a package that concentrates on content, and on that knowledge side. (Teacher 3)

The following comment from Teacher 3 suggested that he regarded the limited use of interactivity in the software as a major shortcoming in the design:

... for example, worksheets where you had to interact with, they would have balancing equations where you would type in a 1 or a 3 or a 5 or a 7. And that was the sum total of the interactivity. So, it really wasn't a sophisticated package from that point of view. So even kids that would maybe work on it one-on-one in a computer centre, it doesn't engage them because there's not much interaction. It's really just a case of clicking on links which then takes you to different content pages. (Teacher 3)

Teacher 3 described what he expected from suitably designed multimedia software in the following extracts, which suggest that he wanted a software package which served as more than an electronic textbook:

... you know ... to show kids screens with content on ... I mean, they don't want to look up at a screen and read it and say "Well, okay, we could read it out of the textbook" ... except reading out of the textbook's easier.

... at the end of the day it's a SMART Board that you're using, so it's got to be something that's very visual and very dynamic. So ... for example ... if you're going to have a model of an electric circuit ... you physically want to see these charges moving through the circuit and seeing what sort of happens when they split up in parallel, etc. You want children to understand the difficult concepts by seeing something that's very visual. That's the sort of thing. And if there are experiments you want them to be dynamic, explosive kind of experiments. You don't want to see ... you know ... putting litmus paper in an antacid solution and seeing what colour the paper goes. I mean ... they don't want to see that. They want to see exciting things going on. But it has to be visual. Anything that is content-related ... portraying it in that way is just useless. (Teacher 3)

In his comments Teacher 3 makes it clear that he wants to use software that will allow him to present dynamic images on the SMART Board. One of the benefits of using interactive whiteboards is the ability to present multimedia resources. Multimedia resources include various combinations of pictures, sound, text, and videos. The variety of stimuli in these presentations increases their potential to "capture and hold pupils' attention more strongly than other classroom resources" (Higgins, Beauchamp, & Miller, 2007, p. 215). The use of graphics in multimedia resources also allows learners to visualise processes, which, as Rieber (1995) points out, contributes to improved cognition. Another benefit offered by this type of technology is that it may allow users to interact with the content being presented (Higgins et al., 2007; Kennewell et al., 2007), if the software has been designed to include interactivity. Interactive whiteboards appear to be popular amongst teachers: A 2008 report on the state of ICT in UK schools identified, interactive whiteboards as the "dominant technology in schools" (Smith, Rudd & Coghlan, 2008, p. 5). The report pointed out, however, that technology, in general, was mainly being used in classrooms for "presentational purposes" (Smith et al., 2008, p. 5). It thus appears that teachers may not be making full use of the interactivity offered by using interactive whiteboards. In addition, researchers (e.g. Kennewell & Beauchamp, 2007) have questioned whether it is predominantly teachers or learners who are interacting with the content being presented. In a whole class setting, usually only one or two learners are able to interact with the whiteboard at a time, which does not allow the full benefits of one-on-one learner interaction with the software package. While Teacher 3 appears to be clear on what type of software he wants to use in conjunction with the SMART board, he is focusing more on the presentational aspects than the interactive aspects of the SMART Board. In his comment above he was
emphasising what he wanted his learners to be able to see on the whiteboard, and not what he wanted to be able to do, or what he wanted his learners to do.

I recorded the following overall impression of the software in my log, in relation to package’s focus on content:

...the software appears more useful as a reference tool than a teaching and learning tool.
(Researcher’s log, 1 June, Year 1)

- Problems with the navigational design of the software package. As one of only two teachers who used the software, I initially experienced difficulty navigating through the package. Teacher C had not specifically mentioned any problems with finding his way through the package, but this could be because he stopped using the software once he was convinced it was not useful. My initial concerns about the poor navigational support provided by the software were backed up when I later evaluated the interface design features (see Chapter 5).

**Problems arising from time needed to bookmark content**

The software is not designed so that the content is arranged into specific lessons or aimed at specific grades. The fact that the content was not arranged for specific grades or into distinct lessons would make it time-consuming for teachers to prepare lessons using the software. In the meeting with the managing director of the software company, Teacher C and I had asked Mr C about this problem:

T3 also pointed out that there is no distinction between lessons for different grades, to which I added that the software doesn’t seem to be arranged in distinct lessons. Mr C’s response was that teachers would have to bookmark information from different parts of the software to make up a lesson.
(Researcher’s log, 7 June, Year 1)

The bookmarking of content referred to by Mr C would require teachers to search the software to find content appropriate to a particular grade and then to arrange the content into an order appropriate for teaching within the South African curriculum (as discussed at the top of page 106). In a discussion with Teacher 3 immediately after the second meeting with Mr C, Teacher 3 pointed out that even in areas where the software contained content required by the South African science curriculum, there was still lots of work that teachers needed to do before they could use the software in their lessons.

...there were certain aspects of overlap ... but as a result ... even in an area that was covered, it requires considerable work on the part of the teacher to go through it and to see exactly what is appropriate and what is not appropriate ... and to flag the different sections. (Teacher 3)

I previously made the comment that “where software is judged unsuitable, teachers might be less inclined to use it”. This comment is supported by evidence from other studies. Science teachers in the study by Ng and Gunstone (2003) were reluctant to use software that did not meet their needs while in the Turkish study by Sahin and Thompson (2006, p. 88), “a lack of appropriate instructional software” was one of the most frequent barriers reported by 117 university lecturers. The unsuitability of the software package in this study led to teachers eventually not using it. Teacher 3 summed up his feelings about the lack of suitability in the following comment:

...the SMART Board is only as good as its software and if you don’t have good software the SMART Board is absolutely useless. Certainly, my experience with this software ... the couple of lessons that I did, and I did them with a couple of different classes ... I took pretty much the best that I could find for the Grade 8s and I showed the Grade 8s, and for the one Grade 11 class as well, some aspect that applied, and the lessons were disasters. The kids sat there, they were bored out of their mind; they didn’t learn a single thing. I think, for them, if I had to go in there again and say “Right, we’re going to do something on the SMART Board”... they’d actually be saying to me “No, please. Let’s rather do normal work”. (Teacher 3)
Teacher 4 summed up the situation with the software in an email she sent to me in September, Year 1:

"The software does not get used. It has been installed, tried and dumped which is a major waste of time and money. (Teacher 4, September, Year 1)"

B2: Issues relating to the lack of suitable software

In the 48 studies I reviewed for factors affecting teachers' use of computers, the quality of software being used for teaching emerged more frequently as a factor influencing teachers' computer use than the availability of instructional software or the ease of use of software (as discussed on page 37 in Chapter 2). In this study, however, the lack of availability of instructional software emerged as a more important factor. One of the possible reasons for the shortage of available software could be that the college was very young (only in its third year). Teacher 1 mentioned two software-related problems that prevented her from using computers in her teaching:

- **Not having the ‘ideal’ software available.** The type of software that would make Teacher 1 more inclined to use computers in her lessons was not available in the school. She explained how this discouraged her from using computers:

  "... the reason is because I don’t have the ideal package. I saw the Grade 1 package on how to draw a 3-D drawing. I’m sure I could teach 3-D a little bit ... give a new angle to a lesson if I got them to do it on the computer. (Teacher 1)"

- **Not being informed by the school about the software available in the school.** Although this qualifies as an institutional issue (see discussion on institutional issues in the next section) I have decided to discuss in this section on software-related factors hindering teachers' use of computers. Two teachers complained about not being kept informed about what software the school had. Teacher 1 described having heard that a particular package that she could make use of was available in the school. She had not, however, been officially informed about the package being available, and had therefore not used the software. She also described having attended a demonstration of another software package that was available in the preparatory school, but which she had also not been officially informed was available in the college. Teacher 2 also described not having been made aware of the software available in the school:

  "... I’m not aware of what the computer centre has available ... which ... and I would like to be aware of that. We’ve been told we’ve got a really fantastic one, but I don’t know. Maybe it’s a communication thing. (Teacher 2)"

In this study, it appears that a lack of software was not the only software-related factor affecting teachers' use of computers. A lack of timely communication played a role in teachers' not being aware of what software was available in the school.

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16 The software was only fully installed in July of Year 1, so this comment was made two months after the software was operational.
C: Institutional factors within the school

Eight of the 21 factors (38%) impacting on teachers’ use of technology for teaching in the college fell into the category of institutional factors within the school. These included the poor accessibility of the computer facilities, lack of financial resources to purchase additional hardware, and a perceived lack of support for teachers wanting to include technology in their lessons (see the concept map in Figure 26 on page 92).

C1: Financial issues affecting availability of computer facilities

The availability of sufficient funds to purchase computer hardware and software appears to play a major role in limiting the availability of computer facilities for teachers to use (see Bauer & Kenton, 2005; Ertmer et al., 2012; Wood et al., 2005). Three financial issues that negatively impacted on teachers’ use of computers emerged from the study.

Lack of budget to buy computers

I have already alluded to the fact that the real reason for the shortage of computers in early Year 1 was the financial constraints placed on T4 before March Year 1 (see Information Box 1 on page 96). I suspect she was not allowed to purchase computers before the end of the financial year (end of February, Year 1). The technical problems teachers were led to believe were behind the computers being unavailable appear to have been a distraction from the financial constraints under which the school was operating.

Lack of budget to employ dedicated SMART Board teacher

Financial constraints also appear to have been behind the school’s inability to employ a dedicated SMART Board teacher. In my interview with Teacher 3, he acknowledged the benefits of having such a teacher, but also mentioned that the expense involved was prohibitive:

... I think the schools that are most successful are those that almost have a dedicated, SMART Board-type teacher, whose role is it to go and find and evaluate all the software as well as to go and find ... e.g. the teacher will say ‘I’m going to teach electricity’ and the SMART Board teacher will then spend a lot of time surfing the net, trying to extract stuff and then would be able to say “Right, I have found the following 4 sites for you to go and evaluate”. And then that’s a lot quicker, because, I mean, in terms of the net, the net is so vast ... you know, you could spend 2 hours and have not come across a single thing. So, I think it’s working to an extent in those sort (sic) of schools, but obviously there’s great expense where that is concerned. (Teacher 3)

In my experience, however, I have not come across a school with a dedicated SMART Board teacher. The teachers with whom I have discussed SMART Board use find their own resources (e.g. websites or learning objects) to use on the SMART Board.

Financial considerations, not use, determine who gets a SMART Board in classroom.

Financial constraints continued to play a major role in my access to computer facilities. Having changed my focus from using the computer lab to using the SMART Board in my lessons, I was very interested when rumours started doing the rounds in early Year 2 that the SMART Board was to be moved to a new venue. The following extract from my log shows how financial constraints (and not
who would be able to use it most effectively) determined where the SMART Board would be moved to:

In a meeting with T6 today I raised the issue of the SMART Board. T6 said they are in the process of expanding the wireless network by putting in more wireless points. One of these is going to be in the science block directly above my lab. He said that what they could do would be to weigh up the cost of moving the SMART Board from its present location in what is currently the Afrikaans classroom to the geography room against the cost of moving it to the biology lab. It will cost about R7 000 to move it to the geography room. If it costs less to move it to the biology lab, then that would weigh in favor of moving it to the lab. (Researcher’s log, 2 February Year 2)

In the end, neither the geography nor biology departments got the SMART Board. It was moved to the lecture theatre, which is directly alongside the classroom where it was previously housed. This venue already had a wireless point, which suggests that the cost involved in moving the SMART Board to the lecture theatre would have been lower than moving it to either the geography classroom or the science block. The decision about where to move the SMART Board appears to have been based, at least partly, on financial considerations. Another possibility is that the decision was influenced by the ‘neutrality’ of the lecture theatre: by moving the SMART Board to the lecture theatre neither the science nor geography departments could be offended.

**C2: Poor accessibility of the computer facilities**

*Information Box 3* provides information about the location of the various computer facilities in the school.

*Information Box 3*

All computers for learner use were housed in the computer lab and the media centre, which are in the same building. The computer lab, which teachers had to book in advance to use during a lesson, contained 26 computers (sufficient for most classes). The IT teacher (Teacher 4) taught Computer Science in the computer lab. The four computers in the media centre were available to learners outside of lessons. The librarian supervised the use of these computers during the school day (i.e. during break time), but after school her duties focused on helping and managing learners working in the library. The SMART Board was located in a classroom used by the Physical Sciences teacher (Teacher 3). Teachers had to book to use the SMART Board, which also involved arranging with the science teacher to swap classrooms.

Because of where the computers and SMART Board were housed within the school, these facilities were not always accessible when needed. Ideally, in biology, computers would be used to teach learners more abstract sections of work, or experiments not easily performed in a school laboratory, or about processes where they would benefit from viewing animated versions of complex procedures not easily explained by the teacher, such as how enzymes function. This could be done on individual computers operated by the learners or using a SMART Board operated by the teacher or volunteer learners. The relevant software is often required only for certain portions of a lesson, and it is not ideal, therefore, to have to move to another venue in order to access the computers. Moving is inconvenient and wastes valuable teaching time, especially if computers are needed only for portions of a lesson. Similar problems teachers encounter when having computers in a central location are mentioned in the literature (e.g. Bauer & Kenton, 2005).
Two types of administrative issues which affected teachers’ use of computers emerged from the study. The first type related to the availability of the computer facilities, while the second issue related to the booking of the computer facilities. Of the five teachers in the study, Teacher 4, (who taught computer science in the computer lab) and Teacher 3 (who taught in the SMART Board room during Year 1) were not as likely as the other three teachers in the study to have experienced problems with accessing or booking the computer facilities.

**Poor accessibility of available computer facilities**

Table 11 is a summary of the administration issues related to the difficulties teachers reported with gaining access to the computer facilities.

**Table 11. Administrative issues relating to accessibility of computer facilities**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Teachers</th>
<th>Frequency count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer facility not available because it is in use for teaching of Computer Science or has been booked by another teacher.</td>
<td>T1, T2, R</td>
<td>3</td>
</tr>
<tr>
<td>Computer lab not available to learners in the afternoon.</td>
<td>T1, T2</td>
<td>2</td>
</tr>
<tr>
<td>Computer lab/ SMART Board room not available because computer teacher is absent and no provision was made for someone else to fill in.</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td>Lack of availability of computer lab for some classes results in parallel classes getting out of step.</td>
<td>T1</td>
<td>1</td>
</tr>
</tbody>
</table>

The literature suggests that the major difficulty with teachers gaining access to computer laboratories revolves around the computer laboratories being used for the teaching of computer science, leaving limited time for other teachers to use them (Bauer & Kenton, 2005; Ng & Gunstone, 2003). An extreme example of this would be the study by Chigona and Chigona (2010). These researchers highlighted the problem of the computer laboratories installed in secondary schools in the Western Cape (South Africa), as part of the Khanya Project, only being accessible to maths and English teachers.

The following issues relating to the accessibility of the computer lab/ SMART Board room made it difficult for the teachers who participated in the first phase of this study to use computers in their lessons:

- **The computers were being used for another lesson.** The three teachers who needed to book the computer lab described instances when they could not use the computer lab or the SMART Board room, and the impact this had on their teaching. In my interview with her, Teacher 1 described the problems around gaining access to the computer lab as a major disincentive for using computers in her lessons. Teacher 2 felt that she would make more use of the computer lab if it was easier to gain access to it:

  ... I just feel that they're not that accessible ... I struggle ... I know I would ... if they were more accessible ... I would be using them with more of my classes. (Teacher 2)

I had similar difficulties accessing the computer lab:

I investigated the possibility of booking the computer lab for the Grade 10s for the classification assignment. It seems fine for the Grade 10Bs, but the computer room is being used for the teaching of Computer Science for most of the lessons when I could bring the 10As in to use the computers. It seems as if that effectively rules out the possibility of using the computer room for the Grade 10s for this year. (Researcher’s log, 14 February, Year 2)
Gaining access to the SMART Board room was also a problem, because Teacher 3 had to move out of the room if another teacher wanted to use the SMART Board during one of his lessons. The swopping of classrooms was not always a simple procedure. On one occasion Teacher 3 had swopped with me for two lessons, meaning he would have had his lessons in my lab. Because I feared that difficulties connecting to Internet in the SMART Board room would interfere with my lessons, I decided to move my lessons to the computer lab so that I could access the Internet there. However, just in case I could not connect to the Internet in the computer lab and needed to use my lab, I asked Teacher 3, at short notice, to move back to the SMART Board room. Throughout this complicated process, Teacher 3 remained magnanimous and went out of his way to accommodate my ever-changing lesson venue.

In February of Year 2 teachers were informed at our daily staff meeting that the SMART Board was going to be moved out of Teacher 3’s classroom, to the lecture theatre. There was no explanation as to why it was being moved there. I gathered it was so that it could be more accessible to teachers wanting to use it. However, I experienced a number of difficulties when I tried to use the SMART Board in the new venue. The difficulties I experienced were a combination of

- the room being used for other reasons:

  … arrived at the SMART Board room to find one of the prep school teachers in the room. Apparently she uses the room to teach in”. (Researcher’s log, 12 May, Year 2)

- the room not being available because it had already been booked:

  … tried to book the SMART Board again, but Admin1 said the prep school is using the auditorium for rehearsals, so some prep classes are being taught in the lecture theatre. (Researcher’s log, 2 June, Year 2)

- teachers not being informed that the SMART Board was not available because the computer was in for repairs:

  Tech2 came in about 10 minutes later to explain that the computer had gone in for repairs and would only be back next week. (Researcher’s log, 3 October, Year 2)

The net result of all these factors is that I found using the SMART Board for teaching a complicated procedure fraught with all sorts of difficulties that I could neither have foreseen nor forestalled. A number of other studies have found that teachers are discouraged from using computers for instructional purposes when they encounter numerous difficulties trying to do so (e.g. Baylor & Ritchie, 2002; Ng & Gunstone, 2003).

- The computer teacher being absent. Teacher 1 complained about not being able to access the computer lab when Teacher 4 was away:

  … but then arriving there [at the computer lab] and it’s just been my bad luck that she’s been away or ill every time.

  … and now, at the moment, we’re supposed to do a PowerPoint presentation – their research project. We still haven’t presented on the SMART Board because when I planned it, the computer teacher wasn’t there to consolidate all my files – that the kids worked on – and then to make sure that it was up there. (Teacher 1)

The latter extract suggests two aspects for which Teacher 1 required the computer teacher in this instance, namely the ‘consolidation’ of her files and making sure the files were ‘up there’. The ‘consolidation’ refers to learners’ PowerPoint presentations being saved onto a CD in the computer lab, which would then be taken to the SMART Board room (which at that stage was in
the upstairs venue, hence, ‘up there’) so learners could open their files on the SMART Board computer. At this stage the SMART Board computer was not linked to the school intranet, so learners could not directly access files they had stored on the network.

Another difficulty arose when Teacher 4 was away. Teacher 4 had the key to the computer lab. When she was away the computer lab remained locked. Teachers who booked the lab either could not use it or had to find a master key to open the lab. Often teachers only found out that the computer teacher was away when they arrived, classes in tow, to have their lesson in the computer lab. The loss of time caused by having to dispatch a learner to locate a master key could have serious consequences for the time left in which to conduct the lesson. In September Year 1 it became essential for some provision to be made for someone else to open the computer lab, because Teacher 4 had contracted a serious illness and would be away for an extended period of time. I recorded the following entry in my log about the staff meeting in which teachers were informed about Teacher 4’s absence:

At our daily staff meeting at first break today T6 informed the staff that T4 will be away for a while. The announcement was met with silence while everybody digested the information. Then T1 asked how we are supposed to book the computer room in T4’s absence and what the implications are for teachers who’ve booked it over the next couple of days. T3 proposed and T6 agreed that Tech1 should be available to open the computer room. This doesn’t solve the problem of who is going to provide technical support while T4 is away. Tech1 is based in the staff room, which is quite a distance from the computer lab, so he’s not immediately available to offer assistance. (Researcher’s log, 13 September, Year 1)

The lack of accessibility of the computer lab for some classes results in parallel classes getting out of step. Teacher 1 felt that not being able to be sure that all her parallel classes could get equal time in the computer lab was another serious issue preventing her from using computers more frequently in her teaching (in addition to the problems she had previously mentioned surrounding gaining access to the computer lab): She commented as follows:

... but you know I’m not prepared go in when one class can’t get in every time that lesson because if you’ve got four classes, one class keeps missing and missing. It’s just, it’s such a delay. I mean, it’s such a headache. This is part of the problem I’m got now, including getting in there. (Teacher 1)

- The computer lab is not accessible to learners in the afternoons. In their guide for South African school principals on how to best manage ICT in schools, Bialobrzeska and Cohen (2005) suggested learner access to computers in the afternoons as one possible way of making the best use of school resources. Teacher 1 and Teacher 2 both felt they needed the computer lab to be available to learners in the afternoon. Teacher 1 described how learners who needed to complete PowerPoint presentations in the computer lab could not gain access to the computers in the afternoons:

... and kids couldn’t quite finish their... children that took a bit longer needed to work in the afternoons, and they couldn’t get in to the computer centre in the afternoons to finish their presentation. (Teacher 1)

Learners not having their presentations ready for lessons mean that teachers would have to book the facility again. This could lead to considerable delays, considering the difficulties teachers experienced booking the SMART Board room (as will be discussed in more detail in the next section).

Both teachers wanted afternoon access:
... otherwise I'd like somebody in the library who can assist a child if a child is sent unaccompanied by me. The library teacher is there and she is very helpful, but yeah... (Teacher 1)

...I just feel that in the afternoons that should be available so I could say to my three or four kids that are really needing help, and I know that we've got names of programmes that are available ... we could just send them there and know that they'd be supervised while we're here working with other kids with more specific problems. (Teacher 2)

Problems with booking system for the computer lab or SMART Board room

The need to book the computer lab for use during lessons was discussed in Information Box 3 (page 105). Because the computers are located in a single room and are not available when the teacher is running computer classes, the computer lab has to be booked through the computer teacher. In the following extract I describe the original booking system used by Teacher 4, as I witnessed when I tried to book the computer lab:

It [the booking system] consists of two plastic sleeves in her flip-file in which she has her computer science lesson timetable. She writes down the lessons we book on a small piece of note paper or ticks on the pieces of paper on which we've written down the lessons we need to book (I often go to her with the lessons I need booked written down on a piece of paper so I can go back to the lab and mark off on my calendar which I've successfully managed to book). She then places the pieces of paper she's scribbled on in the plastic sleeve in her file facing her timetable or in the sleeve containing her timetable. When a teacher comes in to book the computer room, she skims the pieces of paper in her plastic sleeve to check whether anybody else has booked that lesson and then confirms or denies your booking. (Researcher's log, 2 November, Year 1)

Table 12 is a summary of the issues relating to the booking procedure. Six of the seven were issues that discouraged teachers from booking the computer facilities (negative signs in the table).

<table>
<thead>
<tr>
<th>Issue</th>
<th>Teachers</th>
<th>Frequency count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Booking system works okay. (+)</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td>Booking computer lab/ SMART Board room is a problem. (-)</td>
<td>T2</td>
<td>1</td>
</tr>
<tr>
<td>Booking system not reliable. (-)</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td>Double booking only discovered when teacher takes class to computer lab/SMART Board room. (-)</td>
<td>T1, T2, R</td>
<td>3</td>
</tr>
<tr>
<td>New booking sheets for week not put up. (-)</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td>Conflicting booking systems cause problems. (-)</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td>Delay in implementing user-friendly booking system. (-)</td>
<td>R</td>
<td>1</td>
</tr>
</tbody>
</table>

(-) perceived barriers to teachers' use of computers; (+): factors which encourage teachers' use of computers

Of the three teachers who used the booking system for the computer room (T1, T2, and myself), Teacher 1 was the only one who felt that the system worked “alright”. The other two teachers were not satisfied with the booking system. Teacher 2 described the problems she had experienced:

... I have a huge problem with the booking system because I've found on a number of occasions, when I have booked ... other teachers have booked as well. (Teacher 2)

I found the booking system to be unreliable:

It had occurred to me yesterday when I checked with T4 about bringing the Grade 11s in during the fourth lesson today that her booking system leaves a lot to be desired. (Researcher's log, 2 November, Year 1)
The booking system used by the computer teacher sometimes led to a double booking, in this case between Teacher 2 and me. The double booking meant that Teacher 2 could not having her planned lesson in the computer lab, and contributed to her class falling further behind with their CTAs.

Well, today the booking system was definitely showed up. T4 had confirmed yesterday that I could definitely use the computer room in the fourth lesson today, but when my Grade 11s were in there, T2 came in to say she had booked the lesson for her Grade 9s. I had seen some Grade 9s popping their heads around the door at the beginning of the lesson, but I hadn’t taken much notice of them as I was preoccupied with getting my class settled. I would gladly have vacated the room for T2 as I know she needs to complete her CTAs, but as there were only ten minutes left in the lesson before we had to go to the auditorium for the ‘best-dressed’ competition, T2 declined my offer saying the lesson was a write-off in any case. (Researcher’s log, 2 November, Year 1)

Teacher 2’s frustration with the booking system led to her and Teacher 1 trying to set up a new booking system:

As I walked towards my car in the car park today, T2 was just leaving. She stopped her car and lowered her window to inform me that she and T1 have discussed trying to set up a new booking system whereby a timetable left in Teacher 1’s pigeon-hole would be filled in by teachers. Ditto for the SMART Board. I think the timetables should be up on the notice-board, not in someone’s pigeon-hole. (Researcher’s log, 2 November, Year 1)

The new ‘unofficial’ booking system contributed to a myriad of problems, and eventually led to a new formal booking system being implemented. Whereas before all bookings for the computer lab and the SMART Board room had to be made through Teacher 4, the new system separated the bookings for the two venues:

The new booking system has been implemented. A timetable has been placed on the door to the computer room, facing out, with T4’s computer science lessons blocked off and a pencil stuck next to it with Prestik. That’s for booking the computer room. The SMART Board schedule has been put up on the door to T3’s office, so that bookings can be filled in. I can’t believe it took us so long to adopt this more ‘user-friendly’ system. (Researcher’s log, 8 November, Year 1)

At the beginning of Year 2 a new computer teacher, T8 took over from T4. The new computer teacher moved the booking form from outside the computer lab to the staff room, which was a further improvement on the system as it is more accessible to staff. Feeling encouraged by the new booking system I recorded the following entry in my log:

There is a new booking form up on the staffroom notice board. It looks very efficient. T8 has put up a table with dates and lessons when the computer room is free and can therefore be booked. I would like to take my Grade 11s in there soon. (Researcher’s log, 24 January, Year 2)

The improved booking system, however, did not alleviate the problem of gaining access to the computer lab. There were very few lessons available for teachers to book, because of Computer Science being taught in the computer lab:

I tried to book the computer room today using the timetable up in the staffroom. The system has definitely been streamlined, but it appears that there are about 2 lessons a day that can be booked. The rest of the time the computer room is in use for the teaching of Computer Science. The chances of the computer room being available when one needs it are very slim! (Researcher’s log, 27 January, Year 2)

Once it became clear that I would not be able to use the computer lab as much I would have liked, I turned my focus to using the SMART Board in my lessons. I did not consider this an ideal situation, as SMART Boards do not allow differentiated learning to the same extent as learners using individual computers. Another reason, is the limited interactivity possible when using a SMART Board, as pointed out by Kennewell and Beauchamp (2007).
C3: Lack of support from the school for teachers wanting to use computers

I identified – from the 48 studies I reviewed in Chapter 2 – a lack of adequate support for teachers wanting to use technology as the major factor hindering teachers’ use of computers (see Figure 7, page 33, Chapter 2). In my study, a lack of support for teachers wanting to use computers emerged as one of the major subcategories, comprising six factors (see Figure 26, page 92).

Before discussing the six factors, the reader needs to be informed about the technical support available to teachers during the initial phase of the study, and ease of access to technical support. Information Box 4 provides information on what support was available to teachers. During the first phase of the study, Teacher 4 was the only technical support member, so the teachers’ comments about the technical department largely refer to Teacher 4.

Information Box 4

Early in Year 1, Teacher 4 was the sole source of technical support for all teachers in the school. Teacher 4 was based in the computer lab, where she taught Computer Science. Later in Year 1 Tech 1 was appointed to the technical support staff, which eased the burden on Teacher 4 somewhat, but did not relieve many of the problems teachers were experiencing. Tech 1 was located in a different venue to the computer lab. In Year 2 Teacher 8 took over from Teacher 4 as computer teacher, and another technical support person (Tech 2) was appointed.

The problem of having a full-time teacher who was also expected to provide technical support to other teachers has emerged as an obstacle in other studies (e.g. Russell & Bradley, 1997). The computer teacher (T4) carried a heavy load as computer science teacher and, initially, provided the only technical support for both the preparatory school and the college. The increase in the number of technical staff described in Information Box 4 was offset by the appointment of more teaching and administrative staff as learner numbers increased. Another issue relating to the technical staff is where they were based. Besides the computer teacher based in the computer lab, the other technical staff were located in another venue. Teachers needing technical support had to contact a technical staff member on their landline or they had to send a learner to locate one of the technical support staff to help, which often proved time consuming.

Support staff not available or unwilling to help

The teachers related instances when the insufficient number of technical staff meant that they could not get the support they needed. This meant that teachers either had to sort out their problems themselves, or they had to get other members of staff or learners to resolve the technical problems, or they just had to wait until they eventually received the assistance they needed:

... so then I’ve got to do it and when there’s a problem with a machine I don’t have the ability to fix it or I’m not competent enough to fix it or to ... technical hitches ... yeah ... I have a problem with and then I can’t help the children with the work when I’ve got technical problems to sort out. (Teacher 1)

... I find there are a lot of technical problems, which I think should be sorted out by the computer department and not by staff and learners. (Teacher 2)

I sent a pupil to my lab to collect my laptop and said that I could connect to the SMART Board using my laptop, but that I don’t have the software on it. While we were waiting for my laptop to arrive, Tech2 went to collect the CDs for the _____ software from his office. He then installed the _____ software
on my laptop. So, finally, I now have the software that I’ve been trying to have installed since May.
(Researcher’s log, 3 October, Year 2)

A lack of technical support was identified as the most significant external barrier in the study by
Ertmer et al. (2012).

**Issues relating to ICT training**

I discussed in an earlier chapter the concept of ‘technological knowledge’ (Chapter 2, pages 53-56).
According to Mishra and Koehler (2006) teachers wanting to integrate technology into their teaching
need to know the different types of digital technologies available and how to use them, what software
tools are available, how to install and remove software, and how to install and remove peripheral
devices like printers and scanners. This technological knowledge must be used in conjunction with
pedagogical knowledge and content knowledge when teaching a particular topic using technology. As
pointed out in Chapter 2 (pages 37-38), in-service training is one way that institutions can support
teachers with developing technological knowledge while carrying out their normal duties.

*Information Box 5 describes the training teachers had received up to the time I interviewed them.*

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**Information Box 5**

In-service training provided to teachers prior to the interviews:
- a demonstration of how to use a SMART Board (July, pre-study year)
- a proposed demonstration of how to use a new marks programme called Pencilbox, which had to be
cancelled.

---

Teachers expressed the following problems with the in-service training provided:

- **Workshops not meeting teachers’ needs.** Teacher 1, who had not had any formal ICT
training, appeared to want training that focused on how to prepare lessons using computers,
rather than workshops on how to use specific software applications. She made the following
comments about workshops:

  … I’m not in favour of these workshops because I’ve just seen these workshops where you …
  it’s not really what we need … they’re not aimed at what I want out of it.
  … I want to know how to take all this data and put it together… in the shortest possible time
  frame. (Teacher 1)

- **Insufficient training.** Teacher 2 described her training needs as follows:

  … I feel there needs to be more staff training. I would like to have a lot more staff training than
  there has been.

  … technically, and then leading on to what software's available. Technically, in terms of the
  SMART Board room … it kind of started, and I don’t think we’ve made use of that SMART Board
  room. I think it’s a fantastic facility -- apparently we’re getting another one – and we need to be
  using it. And then, also, in terms of what software and how all the different programmes work.
  I’d love to go on a few courses. (Teacher 2)

- **Training scheduled to take place at times that were not appropriate for teachers.** I noted
  that the time for which training was scheduled was not always convenient for teachers. For
  example, the SMART Board demonstration in the pre-study year (prior to the purchase of the
  SMART Board) had taken place during our mid-year exams, making it difficult for some
  teachers to attend it because they were marking scripts.
Scheduled training not taking place. Another problem I noted was scheduled workshops being cancelled. For example, a workshop on how to use the new marks package, *Pencilbox*, did not take place because of technical problems with the SMART Board. Instead, teachers were given a handout outlining what they needed to do when entering their marks and comments for reports. Some teachers, however, still needed to be shown how to enter their marks and comments onto *Pencilbox*, suggesting that the training session had been necessary.

Insufficient ICT training, and the lack of training designed to meet teachers' needs, could have contributed to the lack of ICT confidence and ICT competence displayed by Teachers 1 and 2 during the early stages of this study, as will be discussed later in this chapter. The issue of in-service training, because it impacts on teachers' levels of confidence and competence when supplied with ICT hardware and opportunities for teaching with technology, emerged as a significant factor affecting teachers' use of technology, as will be discussed in Chapter 7, which reports on the factors affecting teachers' use of ICT for instruction which emerged during the second phase of the study.

Issues relating to poor communication

In my interview with Teacher 2 she mentioned a lack of communication as a possible reason why teachers were not aware of the software available in the school (see page 103). I experienced a number of issues concerning a lack of communication in the school during the first two years of the study (Year 1 to Year 2) (see Table 13).

<table>
<thead>
<tr>
<th>Table 13. Problems I experienced relating to a lack of communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem</td>
</tr>
<tr>
<td>Lack of communication between executive staff and staff regarding problems surrounding software installation.</td>
</tr>
<tr>
<td>Lack of communication between executive staff and staff regarding software demonstration.</td>
</tr>
<tr>
<td>Lack of clarity around issues regarding readiness of software.</td>
</tr>
<tr>
<td>Lack of communication regarding software removed from computers.</td>
</tr>
<tr>
<td>Lack of communication with staff regarding changes in the booking system.</td>
</tr>
<tr>
<td>Lack of communication regarding data projector being available to teachers for use in lessons.</td>
</tr>
<tr>
<td>Lack of clarity regarding duties of technical support staff.</td>
</tr>
<tr>
<td>Lack of clarity regarding availability of Internet in SMART Board room.</td>
</tr>
<tr>
<td>Lack of communication with staff when SMART Board computer was in for repairs.</td>
</tr>
<tr>
<td>Lack of communication with staff regarding broken globe in SMART Board room.</td>
</tr>
<tr>
<td>Lack of communication regarding moving of SMART Board.</td>
</tr>
<tr>
<td>Lack of clarity regarding availability of computer teacher to assist teachers.</td>
</tr>
<tr>
<td>Lack of consultation with teachers regarding decisions which affect them.</td>
</tr>
</tbody>
</table>

Many of the problems I experienced relating to a lack of communication centred on the combined problems of the installation and readiness of the software package, and the insufficient number of computers available for teaching in the first term of Year 1. The school's Executive Committee failure to inform teachers that there were insufficient computers in the computer lab (there were only two computers), and that computers would only be purchased after the end of February, created much confusion for me. In my eagerness to use the software package, I had frequently enquired from Teacher 4 about its state of readiness, only to be given various reasons why the software was not ready. The following extract form my log illustrates my confusion:
... there are two issues here. One is the lack of clarity surrounding when the computers will be ready. The other is the readiness of the software programme. In all of this, I still don’t know whether the programme has been fully installed. This issue seems redundant if there aren’t any computers available. (Researcher’s log, 22 February, Year 1)

As late as October Year 2, teachers were still not being informed about issues that could impact on their use of computers in lessons. I recorded the following entry about one such incident when I was not informed that the SMART Board computer was in for repairs:

I was furious about not having been told about the computer not being there, so I went to Admin1 to ask whether she had been aware of the situation when I had booked. She seemed completely surprised when she heard what I had to say. (Researcher’s log, 3 October, Year 2)

**Venues not ready for use when class arrives**

Another area where teachers felt they were not getting adequate support is when they arrived for lessons at venues they had booked only to find the venues not ready. Teacher 1 complained about the scanner not being ready when she needed pictures scanned in, and having to wait for the scanner to warm up. Teacher 2 commented:

I’ve found on a number of occasions, when I have booked, they either haven’t … the computers either haven’t been ready to be used or printers are not connected. (Teacher 2)

The following extract from my log describes an incident I experienced when the venue I had booked was not ready for me to use:

I had booked for the Grade 10s, but when we got to the lecture theatre, the place was in a shambles. There was a whiteboard stacked up against the SMART Board, and the computer was gone. I was livid. I sent a pupil to find Tech2 while, together with two male learners, I moved the whiteboard. (Researcher’s log, 3 October, Year 2)

**Issues relating to teachers’ laptops**

In the pre-study year the school announced a plan whereby teachers could purchase laptops through the school:

According to the plan, you could purchase a laptop through the school with a discount afforded to you based on your position in the school hierarchy. So members of the management team got a substantial discount, Grade Tutors get a smaller discount, while ordinary teachers (including subject heads) are not offered any discount. The laptops will be purchased through the school and the teacher will enter into a payment plan with the school to pay back the money (plus insurance). I explored this possibility with T4 sometime during the middle of the year, but it worked out far too expensive. As far as I know, so far only the History teacher has bought a laptop through this scheme. (Researcher’s log, 24 November, Year 1)

Some teachers who were not able to make use of the plan offered by the school purchased their own laptops. I bought a laptop (as previously mentioned), independently of the school’s plan, which I then used in my teaching. I regarded this as a serious lack of support from the school. Not only were teachers financing their own hardware to use in their teaching (whether through the school’s plan or not), the lack of a discount for ‘ordinary’ teachers meant that the school was not assisting these teachers to purchase machines which they could use for teaching purposes.

**Problems with the installation of the software package**

The problems surrounding the initial installation of the software (which resulted in it only being fully installed in June, Year 1) demonstrate the failure of the school to ensure that resources they had purchased were ready for teachers to use. The problems surrounding the software installation started with the initial installation of the package, in November of the pre-study year, being incomplete,
resulting in the sound and graphics not operating correctly. According to Teacher 4, the problem with the initial installation was "utilities that weren't part of the first installation CD's and had to be reinstalled during the April school holidays" (Teacher 4, email communication, 6 September, Year 1). The utility that Teacher 4 referred to is a special package called Windows Commando (which is needed to install the software) and takes approximately 75 minutes per machine to load (Teacher 4, email communication, 6 September, Year 1). Teacher 3 recounted the difficulties he encountered with installing the software on his machine:

... I was given the discs and at that stage there were just a couple of those which were almost demonstration discs. But there was quite a rigmarole in terms of you couldn't just load them and other things had to be done and loaded first on my machine. So my machine couldn't automatically run them. So then, that took a while. (Teacher 3)

The supplier also failed to supply the school with a list of system requirements or installation instructions when the package was purchased in November of the pre-study year, leaving the school totally dependent on the supplier for installation. Teacher 4 described the difficulties she experienced with the suppliers in an email:

There is absolutely no documentation with the software and it is not the kind of stuff that is easy to install. Installing the software to run on 10 machines was a major mission. There is no additional charge for installation but it is a painful process as someone has to come out to the site to fix things. Most software packages are set to allow the end user independence. There is a list of system requirements and a set of easy installation instructions which work with the installer software automating the process for the end user. This software did not have that facility. (Teacher 4, email communication 6 September, Year 1)

The situation was further complicated when the suppliers could not be contacted between January and March "as all their personnel were on a training course in Poland" (Teacher 4, email communication, 6 September, Year 1).

Despite the complicated installation procedure and the lack of support from the suppliers, factors within the school also contributed to the delay in the software being ready to use. It is not clear to what extent the school had tried to get help from the suppliers, considering that we did not have sufficient computers in the computer lab on which the software could be installed and that the server was down for most of the first term of Year 1. I found the suppliers to be helpful, when I contacted them in mid-June of Year 1:

T4 gave me the business card for a Mr C from the suppliers during first break. I contacted him in the lesson before second break (appears he's the MD) and explained that we were having certain difficulties with different versions of the software and that we needed somebody to come out to show us exactly what's going on. Without any hesitation he agreed to come out to the school tomorrow to sort out the installation. He says the problem is with our server. He claims to have installed the package on five computers (wasn't it supposed to have been installed on 6?), but its only running on four. (Researcher's log, Wed 1 June, Year 1)

The above extract shows that there were a number of reasons why we needed a meeting with Mr C. Firstly, we needed the installation problems to be sorted out. Secondly, we needed clarity on the different versions of the software in the school.

Mr C arrived 45 minutes early for his appointment today. T4 came to call me in the lab - I was surprised he arrived at all. After I went to collect Tech1 from his office in the staffroom, he and I went down to the computer room. I explained to Mr C about the discrepancy between the content on T4's computers and the CDs we had in our possession. He immediately knew what the problem is: apparently the version on T4's computer is the 'comprehensive version' incorporating the stuff on the CDs. When I explained that we needed to have the comprehensive version on the laptop as well he offered to come in next Tuesday to bring in the comprehensive version - all 35 CD's of it - and install it on the laptop as well as on the remaining computers in the computer room. Shouldn't we have been given the 35 CDs without having to ask for them? What is the point of having given us two versions? T4 doesn't appear to very
clued up about the status of the installation or what we're supposed to have. (Researcher's log, 2 June, Year 1)

The meeting with Mr C raised a number of issues:

- How many of the problems surrounding the installation actually arose from the supplier's side and how many were due to problems with the school server?

- Why was nobody aware that we had been given demonstration CDs of the software package? Teacher 3 was one of the first people to realise that we had been given only demonstration CDs:

  I was given the discs and at that stage there were just a couple of those which were almost demonstration discs. And then when I finally could view them - yeah - as I said, it was very much just a sort of 'touch-on' of what one was going to get with the whole package. (Teacher 3)

- Why was nobody aware that the supplier had not actually given us the full set of CDs we had paid for? Teacher 4 had said that the full software package consisted of 64 CDs, but Mr C referred to 35 CDs. We only received the full set of CDs in June of Year 1.

4.3 INTERNAL FACTORS AFFECTING TEACHERS' USE OF COMPUTERS

'Internal factors' are those controllable by, or relating to, teachers, hence 'internal' or 'teacher-level factors'. Three categories of teacher-level factors emerged from the study: teachers' ICT profile (teachers' computer experience), their beliefs about using computers, and their attitudes towards using computers for instruction. In my review of 48 papers (see Chapter 2), these three categories together accounted for the majority of the cases of teacher-level factors (93%), identified from the papers (see Figure 12 in Chapter 2, page 44).

D1: The effect of teachers' ICT profile on computer use

'ICT profile' refers to teachers' ICT knowledge and skill, which is often affected by the length of time for which they have been using computers, their level of ICT training, and their positive and negative experiences using computers. This category (ICT profile) emerged from the literature review of 48 papers as the second most important of 14 categories of factors (both external and internal), after support-related factors (see Figure 7 on page 33 in Chapter 2), and the most important of five categories of teacher-level (internal) factors influencing how often teachers use computers for teaching (see Figure 12 on page 44 in Chapter 2).

The study by Sahin and Thompson (2006, p. 86) found that "computer expertise was the most important factor influencing educators' instructional computer use". The findings for the teachers in my study support the viewpoint that the more competent teachers are in using computers, the more confident they will be about using computers in a classroom situation.

Table 14 is a summary of the ICT knowledge and skills of the teachers in the study.
Table 14. Teachers’ level of skills or knowledge about ICT

<table>
<thead>
<tr>
<th>Factor</th>
<th>Sub-factor</th>
<th>Teachers</th>
<th>Frequency count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of ICT competence</td>
<td>Lack of formal training in using computers. (-)</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Some formal computer training in using computers. (+)</td>
<td>T2, R, T3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Teachers show only basic competence in using computers. (-)</td>
<td>T2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Teachers competent in using computers. (+)</td>
<td>T1, T3, R</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Teachers feel comfortable enough to load a computer package on their own and have done so. (+)</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td>Level of knowledge about computer-related issues</td>
<td>Teachers lack knowledge to deal with technical problems. (-)</td>
<td>T1, T2, T3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Teachers lack knowledge to design lessons for computer use. (-)</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Teachers lack knowledge of jargon related to technical issues. (-)</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Teachers lack knowledge of how to use computers in classroom (for teaching). (-)</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Teachers lack knowledge of how to use computers more effectively to involve learners. (-)</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td>Level of skill/knowledge about SMART Board</td>
<td>Teacher has not had any formal training in using SMART Board. (-)</td>
<td>T2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Teachers lack knowledge to design lessons for SMART Board use and to use SMART Board fully. (-)</td>
<td>T1, T2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Teachers aware of what SMART Board can be used for in lessons. (+)</td>
<td>T1, T3, R</td>
<td>2</td>
</tr>
</tbody>
</table>

(-): perceived barriers to teachers’ use of computers; (+): factors which encourage teachers’ use of computers

Where teachers had received computer training and were experienced in using computers, they were more willing to use computers in their teaching than the majority of teachers in the college. Teacher 4, because of her unique position as the computer teacher, is not included in the discussion about teachers’ level of skill and their use of computers.

Teacher 3 and I, both of whom were comfortable about using technology, used computers during lessons. We are both able to use the SMART Board and are aware of the benefits of using interactive whiteboards in lessons. We had both received our computer training outside of teaching. Teacher 3 had only just returned to teaching after a long period in the corporate world. He returned to teaching to take up the position of head of one of the departments in the school (from Teacher 5, the previous head). I had also returned to teaching after a short period in the corporate world, during which I had worked as a data analyst for eight months and had undergone training that included the use of word processing software and spreadsheets. I am comfortable around computers, having used computers in my teaching even before my venture into the corporate world, and considered it a logical step, when I returned to teaching, that I would use computers in my teaching.

Teacher 2 had received some computer training (in Excel) early in her teaching career (about twenty years before I interviewed her). Probably due to the limited extent of the training, Teacher 2 described herself as feeling largely uncomfortable about using computers and had limited experience using them (e.g. she had never installed any software by herself). She was aware of her limited skill and knowledge about computers and expressed a need for more training, especially in the use of the SMART Board. Her reasons for not using computers for teaching, other than when she was required to use them to carry out her CTA, were her lack of skill and experience.
Teacher 1, despite not having had any formal training in using computers, did not allow her limited skills and knowledge about computers to hinder her use of technology. She described herself as competent in using computers and had installed a software package on her own. She appeared confident in her knowledge of computers and indicated that, when sufficiently inspired, she would not hesitate to try something new using computers. As far as her actual computer usage was concerned, Teacher 1 mainly used computers outside of lessons (for processing marks, for preparing lessons using a word processing package, and for finding information on the Internet to use in lessons), but, especially during the first term of Year 1, she was attempting to make more use of the computer facilities than other teachers in the school. I became aware of this in a staff meeting in early March Year 1, when Teacher 1 raised the issue of there not being any computers available for teaching, specifically teaching Computer Science. I recorded the following entry about this incident in my log:

... one of the other teachers (T1) raised the question of learners using the computers, in the daily staff meeting. Her question was "I was just wondering, how the learners are managing with not having any computers available?" T6 referred the question to T5, since T5 is in charge of the computers. T5 said that there had been "a couple of hiccups" and some "technical hitches" but that the computers would be "sorted out by Friday week". T1 then asked how Computer Science is being taught if there aren't computers available. T5's reply was: "It's difficult." (Researcher's log, 2 March, Year 1)

Clearly, other internal factors were motivating Teacher 1's use of technology for teaching.

**D2: The effect of teacher beliefs on computer use**

I have previously discussed the theory of planned behaviour (Ajzen, 1991) (see Chapter 2, pages 45-46), and I present, in Figure 28, a simplified version of this theory, in diagrammatic form. According to this theory, an individual’s beliefs underlie the attitudes they display towards a particular behaviour. Further, an individual’s attitudes are related to their behaviour through behavioural intentions, which Ajzen and Madden (1986, p. 456) define as "... plans of action in pursuit of behavioural goals".

![Diagram: beliefs -> attitudes -> intentions -> behaviours]

**Figure 28. A simplified version of the theory of planned behaviour (Ajzen 1991)**

Beliefs represent the ideas individuals hold about whether something is true or false, whether or not the perception influencing the belief is accurate (Ayayee, 2012). According to Pajares (2011, p. 307), "few would argue that the beliefs teachers hold influence their perceptions and judgments, which, in turn, affect their behavior in the classroom". In this study, three beliefs impacted on teachers' use of computers. The first belief, held by two of the teachers, (Teacher 1 and Teacher 2) was that it was part of the computer teacher's job to help them prepare lessons involving computers. The following extracts from my interview with Teacher 1 reveals the extent of the support she expected from the computer department:

... You know, I see the computer department as an auxiliary part of teaching ... that it [teaching] should be backed up [by the computer department].

... I've sent through the work that I'm going to be doing to the computer teacher ... drawing on her expertise and expecting ... expecting certain expectations [sic] from the computer teacher.

... I send through a design brief of the lesson. And then what I require. Or what my expectations for the children are. Or what they need to do. (Teacher 1)
Chapter 4: Factors affecting teachers' use of computers in the school (Phase 1)

Teacher 1 also commented in the interview about how she did not have the time to prepare the computer room for her lessons, so she expected the computer teacher to have the machines (like the scanner) that she would need ready for use, as well as suggesting that she expected the computer teacher to help her run her lesson:

... and also, time’s such a factor to me. If I’ve got 30 minutes, I need the children to go in and to get the maximum out of that 30 minutes, I don’t have time for ... trying this ... trying this ... trying this ... where do I find this? I don’t have time for the scanner to first warm up and then to ... I don’t have time for that ... pictures must be scanned ... ready ... sent to the kid’s computer to be used. (Teacher 1)

Teacher 2, like Teacher 1, believed that the computer teacher should be helping her when she used computers in her lessons, although her expectations were less demanding than those of Teacher 1. She explained that she had expected the computer teacher to help her throughout the Common Task Assessment her learners were required to do on computers:

As soon as I got my CTAs, when I realized they had to do a PowerPoint presentation, I went to the computer teacher and I said, “This is the story. I’m going to be needing help. I’m going to have to come and book with you. I will need your help with setting up things for the SMART Board room”. And the computer teacher was aware of that. (Teacher 2)

Some of the beliefs these teachers held about the extent to which the computer teacher should be helping them would fall outside the ambit of the computer teacher’s responsibilities (e.g. finding something that could be used as an introduction to one of Teacher 1’s lessons and helping her to run her lessons). However, the perception that they were not getting the level of assistance from the computer teacher they believed they should be getting, discouraged these teachers from using computers for teaching. Al-Fudail and Mellar (2008) identified a lack of support from other teachers as a source of stress for teachers wanting to use technology in the lessons in their study.

A second belief which emerged from the study was that teachers felt that using computers in lessons contributes to delays in completing work. Teacher 1 emphasised how much of a factor time was for her (see extract above) and how important it was not to waste the 30 minutes of lesson time, for example, waiting for computer hardware to warm up. Teachers’ concerns regarding the amount of time it takes to prepare work using technology and to incorporate technology into lessons have emerged in other studies as a factor discouraging the use of computers for instruction (Al-Fudail & Mellar, 2008; Sahin & Thompson, 2006).

The third belief related to teachers’ perceptions of the relevance of using ICT for teaching. Of the five teachers, the IT teacher (Teacher 4) was using computers because her subject required it. Three of the remaining four teachers had chosen to use computers in their teaching because they believed that technology offered potential benefits for their teaching. The following comment from Teacher 3 on the software package (and other comments I have used earlier) suggested that he had a clear idea of why he wanted to use computers in his teaching:

... you know, in my teaching, so often I’ll draw things on the board and I’m sure you’re exactly the same. You draw things on the board to try and give the kids more of an understanding and you’re actually wanting to try and show processes on the board. So you end up scribbling it out and trying to show how something is interacting with something else. That’s what we need the SMART Board for; to be showing that in a decent way, but there doesn’t seem to be too many packages out there that do that. (Teacher 3)

Teacher 1 believed that using technology could contribute to making her lessons more interesting, as she described in the following extracts:
Absolutely ... making a dynamic lesson. I'm really keen on lessons ... with movement ... that are dynamic ... that move ... visually stimulating lessons. (Teacher 1)

For myself, the case study school provided me with the perfect opportunity to include technology in my teaching, especially when the SMART Board and software package were purchased. I have described a number of situations where I had planned lessons using technology, both in the computer lab and in the SMART Board room. In early October Year 1 I attended an informal meeting with other biology teachers where interactive whiteboards like the SMART Board were discussed. The following extract from my log shows how this meeting stimulated my interest in using technology in my teaching:

My interest in using the SMART Board has been stimulated, especially with all the cool animation sites discussed at the BUG lunch. The one that shows the transpiration stream moving through a tree really sounds interesting. (Researcher's log, 1 October, Year 1)

The fifth teacher, Teacher 2, was only using computers because she was required to do so to complete her CTA with her Grade 9s. The extract below suggests that she only began to perceive some relevance of using ICT for teaching when she became aware of her learners' reactions to using technology for the CTA:

... but seeing the children's reaction and feedback and how it's a completely different medium for them ... it encouraged me to want to do it more. (Teacher 2)

D3: The effect of teacher attitudes on computer use

Attitudes are an important link between the beliefs an individual holds and their decision to carry out a particular behaviour (see Figure 28 on page 120). Individuals' beliefs influence the attitudes they display (Ajzen & Madden, 1986), which, in turn, predispose them "to respond positively or negatively to things, people, places, events or ideas" (Shrigley, Koballa, & Simpson, 1988, p. 668). Since attitudes involve positive or negative judgements, they are regarded as powerful determinants of whether or not individuals will carry out a particular behaviour (Koballa, 1988; Shrigley, 1990).

Teachers' attitudes towards using ICT for instruction emerged from my review of 48 papers as the third most important of 14 categories of factors (both external and internal) (see Figure 7 on page 33 in Chapter 2). It also emerged as the second most important of five categories of teacher-level (internal) factors identified from the 48 papers (see Figure 12 on page 44 in Chapter 2).

Table 15, on the next page, is a summary of the five categories of attitudinal factors towards using technology, identified from my study. These factors are discussed after the table.
Table 15. Teachers’ attitudes towards using computers

<table>
<thead>
<tr>
<th>Factor</th>
<th>Sub-factor</th>
<th>Teachers</th>
<th>Frequency count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confidence level</td>
<td>Teacher confident about using computers. (+)</td>
<td>T1, T3, R</td>
<td>3</td>
</tr>
<tr>
<td>Enthusiasm for using ICT</td>
<td>Teachers would like to be making more use of computers in lessons for teaching. (+)</td>
<td>T1, T2, T3, R</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Teacher excited about prospect of viewing software. (+)</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Teachers would like to be more aware of software available in school. (+)</td>
<td>T2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Teachers would like more training on use of software available in school. (+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovativeness</td>
<td>Teachers cautious about trying out new things on computers. (−)</td>
<td>T1, T2</td>
<td>2</td>
</tr>
<tr>
<td>Frustrations with using ICT</td>
<td>Teacher frustrated by lack of availability of computers. (−)</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Teacher frustrated at lack of clarity around availability of SMART Board room. (−)</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Teacher would have preferred to view full package rather than demo version of software before purchasing it. (−)</td>
<td>R, T4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Teachers frustrated at delays in accessing software. (−)</td>
<td>R, T4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Teachers reluctant to use unsuitable software. (−)</td>
<td>R, T4</td>
<td>2</td>
</tr>
<tr>
<td>Fear of using computers in lessons</td>
<td>Teachers are afraid to use computers in their lessons. (−)</td>
<td>T2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Teacher feels uncomfortable when problems arise with using computers in lessons. (−)</td>
<td>T1</td>
<td>1</td>
</tr>
</tbody>
</table>

(−) perceived barriers to teachers’ use of computers; (+) factors which encourage teachers’ use of computers

The effect of teacher confidence and enthusiasm for using ICT on computer use

Teachers’ levels of ICT confidence refers to how confident teachers feel about using computers in their classes. As discussed in Chapter 2 (page 49), higher levels of self-confidence could predispose teachers to making more use of ICT in the classroom, whereas a lack of self-confidence could discourage teachers from using computers. Teachers 1, 3, and myself, all of whom were using computers without being required to do so, were confident about our ability to use computers for teaching. Teacher 2, who lacked confidence in her ability to use ICT, only used technology when required to.

Similarly, where teachers have a positive attitude towards information and communication technologies, they are more likely to use them, but a positive attitude alone is not sufficient to ensure computer use for teaching. For example, in the study by Ng and Gunstone (2003) 95% of the teachers displayed positive attitudes towards using computers, but only 43% actually used computers in their teaching. In my study, three teachers were enthusiastic about using computers for teaching: Teachers 1, 3, and myself, the researcher, whereas Teacher 2, who was only using computers because she had to complete her Grade 9 CTA, was less enthusiastic. Teacher 2 appeared to be overwhelmed by the difficulties of gaining access to the computer lab and possible technical problems.

The effect of teacher innovativeness on computer use

Teachers’ level of innovativeness emerged from my literature review as the second most significant of the seven teacher attitudes affecting teachers’ use of computers (as discussed on pages 49-51 in Chapter 2). My intention was to use my inferences from the interviews with teachers to classify them into one of the five adopter categories identified by Rogers (1962), as has been done by other
It would not be appropriate to classify Teacher 4, the Computer Science teacher, into an adopter category, as she had no choice but to use computers on a daily basis in her teaching.

Rogers’ system of classifying individuals is based on the rate at which they adopt innovations (see Figure 16, Chapter 2, page 50). For example, according to Rogers the first 2.5% of the individuals to adopt an innovation would be classified as Innovators. In my study, given that there were only 15 teachers at the college and that the five teachers who participated in the first phase of the study had been specifically chosen because they were among the first of the 15 teachers to be using computers for teaching, it seemed inappropriate to use only rate of adoption as a criterion for classifying teachers. Doing so would mean that all five teachers in my sample would have to be classified as Innovators. I therefore had to rely on other characteristics Rogers describes for the adopter categories when classifying teachers into one of the five groups.

I would be judging ‘teacher innovativeness’ by how teachers are using technology for instruction. This decision was based on the fact that the characteristics Rogers’ describes for the different adopter groups are general descriptions and were not formulated to apply specifically to teachers. This difficulty resulted in many rounds of discussion with my supervisor about the most appropriate definition of ‘teacher innovativeness’. One of the issues we discussed was whether to classify teachers based on attitudes or actual behaviours. Baylor and Ritchie (2002, p. 409) describe teacher innovativeness in terms of ‘teacher openness to change’. Van Braak, after acknowledging that ‘innovativeness’ is “context and object dependent” (van Braak, 2001, p. 43), defined teacher technological innovativeness as a “personal willingness to adopt a technological innovation in one’s own teaching practice” (van Braak, 2001, p. 47). However, ‘teacher openness to change’ and their ‘willingness to adopt a technological innovation’ do not reflect their behaviours. Rather, these descriptions reflect an intention to carry out a type of behaviour, namely, using technology for instruction. It therefore seemed most appropriate to focus on how teachers are using technology for teaching, within the context of the study, that is, the specific conditions which existed at the case study school during the first phase of the study.

It is important to note that the four teachers I would be classifying (excluding Teacher 4) were all using technology for instruction despite having to contend with insufficient hardware, software and technical support, and various technical problems. Despite the shortcomings of their situation, the four teachers were using computers ahead of the majority of the college teachers. None of the four could therefore be described as laggards (individuals who are resistant to change, and who are among the last to adopt an innovation). I classified the four teachers into the following three categories:

- **Innovators**, whom Rogers (1962, p. 169) describes as “venturesome”, which suggests someone who is bold enough to try new things and not afraid to take risks. I have classified Teacher 1 as an innovator, within the context of the school during the first phase of the study. The ways in which Teacher 1 was using computers in the first year of the study were innovative compared to what the rest of the college staff were doing. I have previously described how she had been the one who raised the issue of there not being any computers available for teaching at a
college staff meeting. Her innovativeness was evident in that she set about using computers as soon as they become available (post-March, Year 1). Further evidence for her innovativeness is provided by how she then made use of the computers, especially the SMART Board. In the following extract from my interview with her she describes various lessons in which learners i) had to prepare PowerPoint presentations and then present their work using the SMART Board; ii) use spreadsheets to process data and draw graphs, and iii) edit photographs to produce a magazine cover.

... well I'll have to give examples of what I've done. The Grade 8's did a ... they had to do a research project on culture and diversity and they had to first read up in books, find their pictures and then they had to do a multimedia presentation, using PowerPoint included, of their research that they found. That was the Grade 8's ... can't think of the other one ... oh, I've done bar graphs. Kids had to do bar graphs and then I just did a quick thing on Excel spreadsheets where they had to just put their data on an Excel spreadsheet. And then draw a bar graph from that. Oh, and then also - I forgot we did this one - they had to take a photograph and then they had to put the photograph and edit it and create that photograph, personalise the photograph, edit it, of their product that they made. It's like a magazine cover. (Teacher 1)

I have earlier made reference to Teacher 1's confidence when using computers, despite her lack of formal training. She had also stated that she was not afraid to try something new using computers. Notably, more so than the other three teachers being ranked here, Teacher 1 was aware of different types of software available for use in teaching her subject, and had expressed an interest in knowing what other types of software were available. The extracts below suggested she was actively seeking new ways of integrating technology into her teaching:

... I've picked up the most dynamic lessons with video clippings on the Internet. Why aren't these coming into our classrooms? Why aren't we using these in our classrooms? Computer exams ... I've seen programmes where you can do a biology test on a computer. Why are we still sitting marking tests where we could have computerised tests? Just silly little things like that. You know what? I think there's just so much out there that we are just so unaware of. Not just unaware of, but where do you start?

I found this lesson on the internet where you ... It shows, for example how to use a pulley system and then the little guy's pulling the thing up and visually you can see it happening and then they give the examples of calculations and you just click on a button when all the children have done the calculation - tried it - click on the button and the solution's there for you. So it's a visually active lesson and I wouldn't need a programme for that at all. I mean, it's there. It's on the Internet. You can use it. (Teacher 1)

Sahin and Thompson (2006), in their study, found a significant correlation between attitude and the use of technology for instruction. Examining Teacher 1's approach to using technology revealed that she is not afraid of trying new things and making mistakes. She showed this by using computers, in Year 1 of the study, despite the problems surrounding the availability and accessibility of computers, and the lack of technical and collegial support, and despite her lack of technical skill. She clearly understood the benefits of using technology in teaching, such as the 'visually active lesson' she referred to in the extract above. One of the most notable manifestations of Teacher 1's innovative approach towards using technology is that she actively sought out new ways of integrating technology into teaching.

• Early Adopters. Rogers describes early adopters as more integrated into their social system; respected by their peers and people who often serve as role models for the implementation of reasons an innovation. These features may not always be reliable indicators of whether a person is an Innovator or an Early Adopter. In making my decision about how to classify teachers into the adopter categories, I kept coming back to whether and how teachers were
actually using computers. I have classified two of the four teachers as early adopters, Teacher 3 and myself, the researcher. I could have classified these two teachers as Innovators, but chose not to for the following reasons. Firstly, Teacher 1 had started using computers in teaching well ahead of either Teacher 3 or me. Secondly, comparatively speaking, Teacher 1 was using computers in many more different ways in her teaching than either of us. Thirdly, although both Teacher 3 and I were using computers for teaching well before the rest of the school, we were not using it as extensively as Teacher 1. Fourthly, Teacher 1 was far more aware of the software that could be used in her subject than either of us. Although Teacher 3 and I had made use of the software package when it was made available to us, and were prepared to experiment with it in our teaching, neither of us had actively sought out the package, as would be fit an Innovator. Based on these four reasons, it seemed more appropriate to place Teacher 3 and myself in the Early Adopter category.

- **Late Majority.** This group of individuals adopt an innovation after the majority and to require much persuasion to do so (Rogers, 1962). Teacher 2 was classified in this category because, although she was using computers ahead of the majority of other teachers at the school, she was doing so because she was required to because of the assessment requirements of the Independent Examinations Board. Thus, based on the fact that she was using computers and the majority she could not be classified as a Laggard. However, because she was only using computers because she had to be forced to, she could not be classified in the Early Majority group. This group of individuals, who “adopt new ideas just before the average member of the social system” (Rogers, 1962, p. 196), tend to deliberate before adopting an innovation so that they take longer to adopt than the Innovators and Early Adopters, but do not need to be coerced to adopt innovation. Another reason for placing this teacher in this category is that she was easily discouraged from using computers in her lessons. In the following extract she describes how she is put off by having to book the computer lab, which would be before she actually used computers in her lessons:

  ... you know, when I see a whole timetable with names on, then I just say, “Okay ... now ... I can’t ... I can’t get involved there and I need to move on”. (Teacher 2)

A third reason for placing Teacher 2 in this category was her wariness about using computers. She described her single experience of using the SMART Board in a lesson (which she had to use for her CTA) in my interview with her as “... I think quite daunting”.

When classifying the four teachers into the adopter categories one criterion emerged as an important indicator of a teacher’s level of innovativeness. This criterion relates to whether or not the teacher would take the time and effort required to actively seek out new software to include in their teaching. Identifying this criterion during the first phase of the study proved useful when it came to the second phase of the study, when I needed to classify a larger sample of teachers into adopter categories, and eventually led to the development of a method for placing teachers into one of the five categories.

### 4.4 TEACHERS’ NEEDS

During the interviews a number of issues emerged that would have encouraged teachers to make more use of computers, as summarised in Table 16.
Four of the issues mentioned in Table 16 relate to the extent and nature of ICT training. The study by McCamney (2004) suggested that appropriate in-service training and training which matches teachers’ need for knowledge of what software is available and how to include technology in their lessons could contribute to greater levels of ICT competence. This is an important factor which was explored further in Phase 2 of the study.

**Table 16. Factors that would encourage teachers to use computers**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Issue</th>
<th>Teacher</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of ICT hardware</td>
<td>More computers available for use during lessons</td>
<td>T1, T2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Computer(s) in classrooms for teachers’ use</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td>Accessibility of ICT hardware</td>
<td>A more efficient booking system for easier access</td>
<td>T1, T2, R</td>
<td>3</td>
</tr>
<tr>
<td>Suitability of available software</td>
<td>Provision of more suitable software</td>
<td>T1, R</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>More suitable software designed to meet teachers’ needs in terms of content and design for meaningful teaching and learning</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td>Technical support</td>
<td>Improved availability and quality of technical support</td>
<td>T1, T2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Greater willingness on part of technical staff to help teachers</td>
<td>T1, T2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Additional support for teachers (to find and evaluate software or find information on internet)</td>
<td>T1, T2</td>
<td>2</td>
</tr>
<tr>
<td>Extent of training provided</td>
<td>More staff training on use of hardware and software.</td>
<td>T1, T2</td>
<td>2</td>
</tr>
<tr>
<td>Nature of training provided</td>
<td>Workshops better designed to meet teachers’ needs</td>
<td>T1, T2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>More opportunities for teachers to be exposed to suitable role models for including computers in lessons</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Better information on what software is available and how the available software can be used</td>
<td>T1, T2</td>
<td>2</td>
</tr>
<tr>
<td>ICT competence</td>
<td>Greater knowledge of what the available software can be used for</td>
<td>T1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Improved knowledge of what software is available in their subjects</td>
<td>T1, T2</td>
<td>2</td>
</tr>
</tbody>
</table>

### 4.5 CONCLUDING REMARKS

This chapter reported on the factors which affected teachers’ use of computers in the school during the first phase of the study, based on case studies of four teachers using, or attempting to use, computers, and an analysis of my own usage and reasons for it. While factors at both the institution-level and teacher-level emerged, the lack of ICT resources was a major hurdle preventing teachers from making more use of technology.

One of the factors reported on in this chapter, the impact of software quality on teachers’ use of ICT, is dealt with in more detail in the following chapter (Chapter 5), which reports on the evaluation of the *EduRom* package. The software evaluation has been dealt with in a separate chapter because of its comprehensive nature.

The investigation into the factors affecting teachers’ use of ICT during the first phase of the study entered a second phase following the introduction at the case study school of an innovation promoting the use of ICT for teaching and learning. The second phase is reported on in Chapters 6-8.