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Should there be a future for Tablet PCs in schools?

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Abstract:

Tablet PCs are a relatively new format of computer, which seem to offer features which may be beneficial to schools. The uptake of Tablet PCs by schools has been somewhat limited, not least due to their greater cost than laptops of a 'similar' specification. This paper explores the key question of the extent to which schools should be investing in Tablet PCs, if at all, in preference to other formats of fully functional PCs, drawing on evidence from a Becta funded evaluation of the use of Tablet PCs in schools in England conducted in 2004-2005. The Computer Practice Framework was used to develop a set of questions which helped structure a meta-analysis of the data from 12 case studies that formed part of this evaluation. The methodology used and some limitations of the evaluation are outlined, and the key findings are described. The paper concludes that Tablet PCs do appear to offer significant potential to schools, though this potential was not being fully realised in most of the case study schools. A number of specific circumstances in which Tablet PCs do appear to be the most cost effective option are also identified.

Keywords: Tablet PC, school, impact, Computer Practice Framework, cost effective

Interactive Demonstration: A Microsoft tour of a Tablet PC is accessible from the Microsoft website [1].

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1 Introduction

Computers have been used in schools for over 40 years within the 'developed' world; going back as far as the 1960s in the USA and 1970s in England (Twining, 2002a). During this timeframe there has been a growing emphasis on the role of ICT in education, which is reflected in increasing levels of investment in 'educational' ICT, as well as numerous initiatives at local and national levels and on a global scale. Within the UK, for example, "we have seen significant strategic leadership and investment in ICT by the Government, which has led to a position where ICT policy has now become a key aspect of an ambitious educational reform agenda" (Becta, 2005 p.2).

The Department for Education and Skills (DfES) in England, in their annual survey of ICT in schools (Prior and Hall 2004) reported a steady rise in the numbers of computers in schools. In 2004 the mean computer:pupil ratios in schools in England were reported as:

	Primary schools	Secondary schools	Special schools
Mean computer:pupil ratio	1 : 7.5	1 : 4.9	1 : 3.0

(Prior and Hall 2004 p.10)

The vast majority of these computers were desktops, with significantly fewer laptops and very few Tablet PCs or handhelds:

Average number of computers per school	Primary schools	Secondary schools	Special schools
Desktops	28.8	213.3	32.8
Laptops	8.5	47	10.3
Tablet PCs	0.2	1.6	0.2
Handhelds	0.1	1.3	0.3

(Prior and Hall 2004 p.10)

There are many possible reasons why Tablet PCs are not being widely purchased by schools, including the fact that they are relatively expensive compared with laptops of a 'similar' specification and that Tablet PCs are a comparatively new form of personal computer, having been introduced in November 2002. However, what is unclear is **the extent, if any, schools should be investing in Tablet PCs in preference to other formats of fully functional PCs**. This paper sets out to explore that issue, drawing upon a study of Tablet PCs that we conducted between October 2004 and March 2005.

Further details about this Tablet PC study are provided in Section 2, prior to an exploration of the key question - **To what extent, if any, should schools be investing in Tablet PCs in preference to other formats of fully functional PCs?** - in Section 3. The outcomes of this analysis are summarised in Section 4.

2 The Tablet PC study

2.1 Overview

Becta (2004 p.2) reported that 'the education sector has become more interested in Tablet PCs in schools'. This interest was reflected in a number of reports on Tablet PCs, such as those listed on the Birmingham Grid for Learning website, which refers to Tablet PCs as 'A transformational technology', which 'offers many new ways of working with a computer in the classroom and beyond' [2].

In Autumn 2004, recognising that there was no consolidated evidence on the use of Tablet PCs in schools, Becta commissioned a team, led by the Open University, to carry out a study into the use of Tablet PCs in schools in England. This study included two strands with a total of four elements:

- A literature and projects review
 - a. a literature review (including 'grey publications')
 - b. a phone survey of every Local Education Authority in England
 - c. a web-based questionnaire
- A series of case studies
 - d. one case study in each of 12 Schools in England

A full report on that study, including descriptive overviews of how the 12 case study schools were using their Tablet PCs, is available from the Becta website [3].

2.2 Scope - defining a Tablet PC

The study involved a specific focus on the use of Tablet PCs in schools in England. The study adopted the definition of a Tablet PC included in Becta's Technical Report on Tablet PCs (Becta 2004). Within this definition:

The Tablet PC is a fully functional Windows XP portable computer that can be operated with a digital pen. The pen can be used to control the PC and also to "write" on the screen of the device. Integrated handwriting recognition technology enables users to create handwritten documents. Handwriting can be saved as an image, converted into typed text, and some applications, such as Windows Journal, allow the user to save and search "digital ink" documents. Tablet PCs offer an

alternative to pen and paper, with a more natural and intuitive interface than a conventional laptop computer. Tablets can also be easily carried around providing enhanced mobility and ease of use. (Becta, 2004 p.1)

Tablets PCs are available in two basic types:

- 'slates', which lack keyboards, although they can be connected to a USB keyboard or docking station
- 'convertibles', which come with an integrated keyboard and can be used in either slate or laptop mode.

The original Windows XP Tablet PC operating system was superseded in August 2004 by the Windows XP Tablet PC Edition 2005 (which we will refer to as Tablet 2005). Tablet 2005 provides enhanced handwriting recognition, including greater integration of handwriting recognition with Office 2003. Tablet PCs using either operating system were included within the study.

2.3 Methodology

2.3.1 The literature and projects review

During the last quarter of 2004 a traditional search of bibliographic databases was carried out. This was supplemented with a search for relevant material on the World Wide Web. Whilst the main focus of the study was on the use of Tablet PCs in schools in England these searches were expanded to include any studies of the use of Tablet PCs in education irrespective of country, due to the paucity of relevant published material. These two activities provided details of the available literature as well as a number of relevant projects involving the use of Tablet PCs.

A web-based questionnaire was developed and publicised via emailing relevant contacts and maillists that members of the research team were familiar with. A database of relevant contacts in LEAs in England was developed, consisting primarily of ICT Advisors or ICT Consultants. Four members of the project team carried out phone calls to each LEA contact, using a common set of key questions. They took notes during the phone calls, which they documented fully directly after each call was completed.

2.3.2 The case studies

The literature and projects review (see Section 2.3.1) provided details of over 90 schools in England which were using Tablet PCs. From these a shortlist of schools was selected, which provided the maximum feasible coverage in terms of the following criteria:

- Phase of education (ie primary, secondary and special schools)
- Types of Tablet PC (ie convertibles and slates)
- Organisation of equipment ('owned' or 'shared'; individual, small group, whole

class, etc)

- Variation in usage (who used them - teachers and/or pupils; what did they use them for)
- Experience of using other mobile devices (eg laptops)

Analysis of the information from the literature and projects review raised questions about the use of Tablet PCs, and highlighted areas that needed to be explored further. These formed the key questions that were then investigated within the case studies:

- How were the Tablet PCs being used?
- What impact were Tablet PCs having on staff?
- What impact were Tablet PCs having on curriculum?
- What impact were Tablet PCs having on students?
- Which features of the Tablet PCs were being used?
- What complementary technologies were necessary for Tablet PCs to be effective?
- What were the minimum and optimum levels of resourcing for Tablet PCs to have an impact?
- What were the support issues?
- What were the staff and student development/training issues?
- How did Tablet PCs compare with other mobile devices?
- What impact were Tablet PCs having on the physical and temporal spaces within which staff and students worked?
- What were the key lessons that schools had learnt from their use of Tablet PCs?

Having selected the 12 case study schools, each was allocated a key researcher who acted as the main point of contact between the schools and the project team. To maintain consistency across the five key researchers one set of data collection tools and protocols were used across all 12 case studies. These included:

- A questionnaire completed by the school's ICT coordinator, which was followed by an interview structured around their responses to the questionnaire. The questions asked for data about:

the background and professional experiences of the respondent

the schools ICT infrastructure, resourcing and management

the key questions identified above.

The follow up interview enabled clarification of the questionnaire responses as well as further probing of the key questions.

- A semi-structured interview with a member of the senior management team, which asked for data about:
 - the background and professional experiences of the respondent
 - the overall school context (eg size, catchment area, special features, etc)
 - the key questions identified above.
- Observations of two key users, followed by interviews - key users were staff/students selected by the school in discussion with key researcher. Criteria for selection of key users included that they should be regular users of Tablet PCs and should be willing and able to fulfil the key user role, which included being observed and interviewed, and providing the data indication in the next two bullet points. Schools were encouraged to include at least one child as a key user (if appropriate permissions could be obtained).
- Portfolios illustrating how Tablet PCs were used, compiled by each of the key users
- Logs of Tablet PC use over a two-week period, compiled by each of the key users
- Further interviews with each of the key users to follow up on the portfolios and usage logs

The researchers also made field notes based on their observations and informal discussions with staff and students. In addition, a template was provided for reporting each of the individual case studies before the data collection started. This template was based upon the key questions identified above, and provided the key researcher with a clear indication of the questions that they needed to be able to answer on the basis of the data they collected in their case study school(s). The case studies took place between December 2004 and early February 2005. A meta-analysis of the findings across the individual case studies was carried out in February/March 2005 [3].

2.3.3 Limitations

There are a number of limitations with this study which need to be born in mind when interpreting the data.

Firstly, the length of time needed in order to embed an educational innovation, such as the use of a new technology, is normally measured in years (Fullan and Stiegelbauer 1991) and the longest that any of the case study schools had been using Tablet PCs was two years.

Thus at the time of the study we may have been in a period of transition from the use of

traditional desktop and laptop PC to the effective use of Tablet PCs.

Secondly, it is widely recognised that establishing causal links pertaining to computer use in schools is problematic (Clark, Lotto & Astuto 1984; Schrag 1999; Lewin, Scrimshaw, Harrison, Somekh & McFarlane, 2000; McFarlane, Harrison, Somekh, Scrimshaw, Harrison & Lewin, 2000), and this is made even more difficult with the simultaneous introduction of multiple innovations. In around half of the case study schools the introduction of Tablet PCs coincided with the installation of servers and/or wireless networking. In all the case study schools the introduction of Tablet PCs represented a substantial increase in the level of ICT provision. In many of the schools using the Tablet PCs represented the school's first experience of mobile computers. Thus, it is difficult to be sure of the extent to which any changes or issues evident in the data were due to the Tablet PCs, and/or other changes in the ICT infrastructure, and/or the interaction between these different components or other factors.

Thirdly, there are methodological problems associated with self-reporting (eg questionnaires and computer logs) which may be "prone to inflation and selective memory" (Cuban, 2001 p.120), as has been found to be the case in relation to respondents' estimates of their use of computers (Chalkey and Nicholas 1997). Similarly, there may be a tendency for the presence of a researcher to change the behaviour of those being observed (Chalkey and Nicholas 1997) and for participants to show the researcher what they think they want to see (Atkinson 1993). These methodological problems were at least partially addressed by the range of different sources of data used, which made it possible to carry out methodological triangulation (Blease and Cohen 1990) in order to enhance the validity of the conclusions drawn (Bryman 1988). Similarly, giving the participants the opportunity to comment on the researcher's interpretations, for example in the follow up interviews of key users, provided another form of verification (respondent validation) aimed at ensuring the validity of the data (Blease and Cohen 1990).

2.4 Outcomes

The focus of this paper is on the key question of **the extent to which, if any, schools should be investing in Tablet PCs in preference to other formats of fully functional PCs**. Therefore the paper does not attempt to provide a full review of all the outcomes from this study, which are summarised in two other publications:

- The Literature and Projects Review Report (Sheehy, Kukulska-Hulme, Twining, Evans, Cook, and Jelfs with Ralston, Selwood, Jones, Heppell, Scanlon, Underwood and McAndrew, 2005) [4]
- The Case Study Report (Twining, Evans, Cook, Ralston, Selwood, Jones, Underwood, Dillon and Scanlon with Heppell, Kukulska-Hulme, McAndrew and Sheehy, 2005) [3]

The table below provides an overview of the case study schools in terms of the numbers, types and organisation of Tablet PCs.

Primary	Tablets for		Tablet type	'Organisation'
	staff	Student		
St Mary's		4	Slate	Shared. Small school, cross curricular.
Green Lane		8	Convertible	Shared - withdrawal groups.
St Peter's		15	Slate	Shared - timetabled. Replaced ICT suite.
St Willibrord's	1	14	Convertible	Shared - bookable.
Engayne	Most	60	Convertible	Shared- 4 sets timetabled.
St Francis	1	32	Slate (plus keyboards)	'Owned' by students in classroom of future.
Primary - outreach from secondary				
Wylde Green	1	30	Slate	On loan for half a day per week
Secondary (special)				
Queensbury	1	10	Slate (keyboard for staff)	'Owned' by individual; 'projects' - home use.
Secondary				
Invicta	All	180	Convertible for staff Slate for students	'Owned' by Yr8 students
Cornwallis	92%	200 (approx)	Convertible for staff Slate for students	Shared sets plus 'owned' by 2 classes
Coleshill	34 sets		Slate, wall mounted PC and data projector	Allocated to teaching rooms
Wilmslow	12		Convertible	'Owned' by all staff in PE department

It is clear from this table that within the case study schools it was predominantly the case that teachers were provided with convertible Tablet PCs, whilst students were provided with slates. Throughout this paper, where we refer to teachers' use of Tablet PCs outside the classroom they were generally being used in 'laptop mode' (ie with a keyboard). In contrast, when we talk about either teachers' or students' use of Tablet PCs in 'the classroom' they were normally being used in slate mode. It is also worth noting that the handwriting recognition facility provided by Tablet PCs was not used extensively, even when working in slate mode; students tended to keep their work as handwriting (digital ink) or to use the onscreen keyboard. Where staff were marking children's work on a Tablet PC they also tended to use handwritten comments and annotations.

Section 3 provides an analysis of the data relevant to the key question.

3 Discussion

3.1 Unpacking the key question

In order to answer the key question - **To what extent, if any, should schools be investing in Tablet PCs in preference to other formats of fully functional PCs?** - we need to unpack it.

Amirian's review of the use of Tablet PCs in schools and higher education in the USA (Amirian, 2004) identified cost as being a critical factor. Whilst the price of Tablet PCs is falling it is clear that they are more expensive than 'similarly' specified desktop or laptop computers (Becta, 2004). The extent to which this differential in costs is justified is crucial, and depends upon the additional benefits that Tablet PCs offer relative to other formats of PC. All of the case study schools identified price as being an issue, and four of them had already decided to buy laptops or desktops instead of Tablet PCs in future. When asked whether they thought buying Tablet PCs was cost effective five of the 12 case study schools said they were, and two felt that they would be once they were taking full advantage of them.

"I'd say that Tablet PCs are 50% per Tablet more expensive to purchase and maintain - but we are now getting some returns. They are very much more cost effective as they offer a very flexible solution worth the extra money compared to laptops or desktops." (ICT Team, Engayne)

The Computer Practice Framework (CPF) (Twining, 2002b; Twining, 2002c) provides a framework for thinking about the ways in which computers are used in education, which identifies three key dimensions of practice:

- Quantity: the amount of time that computers are being used
- Focus: the objectives underpinning computer use, which include using computers to: develop IT skills (IT); develop learning in other domains (Learning Tool); and

to enhance other educational objectives (Other).

- **Mode:** the impact of computer use on the curriculum and pedagogy, which includes: enhancing efficiency and effectiveness (Support); changing the curriculum or pedagogy in ways that could have been achieved without the technology (Extend); changing the curriculum or pedagogy in ways that could not have been achieved without the technology (Transform).

Comparing the use of Tablet PCs on these three dimensions, relative to other formats of fully functional PCs, should help to identify what benefits, if any, they offer that might justify their additional cost. The table below presents specific questions based on the CPF that are explored in the remainder of this paper in order to answer the key question of the extent to which, if any, schools should be investing in Tablet PCs in preference to other formats of fully functional PCs

Dimension on CPF		Questions	Section
Focus	IT	When Tablet PCs are available does the quantity of time spent using computers to learn IT increase , relative to that evident with other formats of computer? When Tablet PCs are available are there improvements in IT learning outcomes , relative to those achieved with other formats of computer?	See Section 3.2
	Learning Tool	When Tablet PCs are available does the quantity of time spent using computers as a Learning Tool increase , relative to that evident with other formats of computer? When Tablet PCs are available are there improvements in the learning outcomes in other subject areas , relative to those achieved with other formats of computer?	See Section 3.3
	Other	When Tablet PCs are available are there improvements in relation to other objectives , relative to those evident with other formats of computer?	See Section 3.4
Mode	Support	Do Tablet PCs enable improvements in the curriculum and/or pedagogy , which could not have been achieved more cost-effectively in other ways?	See Section 3.5
	Extend		
	Transform		

3.2 The quantity and quality of learning about IT

It was clear that there was a relationship between the way in which Tablet PC were organised within the case study schools and the degree of impact that they had on the quantity and quality of learning about IT.

Where staff were allocated their 'own' Tablet PC (four secondary and one primary school) they used them extensively and reported that their own ICT skills had increased considerably. The importance of staff ownership of laptops and of the positive impact of 'personal ownership' of laptops on teachers' ICT competence and confidence is already well documented (eg Becta, 2001; Becta, 2002; Fairfax County Public Schools, 2003). It was evident within the case study schools that staff, who almost invariably were provided with a convertible type Tablet PC, tended to use them in laptop rather than slate mode outside the classroom. Thus any increases in the amount of ICT use or ICT competence were as likely to have been due to having a portable computer as to the fact that it was a Tablet PC.

Where staff had shared access to one or more Tablet PC they tended only to use them for teaching or for preparing to use them in a lesson. Staff reported that where they were using Tablet PCs extensively for teaching, even if they were not using them for anything else, their ICT confidence and competence increased. Teaching either meant using the Tablet PC in conjunction with a data projector or supporting children who were using Tablet PCs.

The availability of Tablet PCs did appear to substantially increase the amount of time during which computers were in use in the classrooms, where they tended to be used in slate mode. A Tablet PC in slate mode was seen across the case study sites as having advantages relative to a laptop, which might help to explain the relatively high level of use reported, including:

- taking up less space in the classroom
- being easier and quicker to pass around (for example so that children could input data when being used with a data projector)
- being more mobile in terms of being easier to use 'on the go' because you can hold the Tablet PC in one hand and write on it with the other
- the pen being easier and more intuitive to use than a tracker pad on a laptop or conventional mouse.

There seemed to be a direct relationship between the amount of time that an individual spent using a Tablet PC and their level of IT competence. Where students were allocated their 'own' Tablet PC for a prolonged period (typically for the whole school year) pupils used them for between 25% and 75% of school time, compared with around 10% where Tablet PCs were being shared between classes. There was universal agreement across all 12 case studies that the Tablet PCs had a positive impact on ICT competence, and reduced the emphasis on the teaching of discrete ICT:

Discrete ICT is becoming a thing of the past, as staff begin to realise the importance of embedding ICT skills into other areas of the curriculum. Spreadsheets are used to support the teaching of maths, science, history, geography, etc - not as cold, standalone spreadsheet activities that bear no link with real-life application. (ICT consultant, Engayne)

3.3 The quantity and quality of learning about other subjects using ICT

As already indicated the introduction of Tablet PCs increased the amount of ICT use in all the case studies and was leading to greater integration of ICT across the curriculum. In most of the case study schools the Tablet PCs were used across all subject areas.

'Their size and portability means they can be used by the whole class in a normal classroom, and this means they can support and extend teaching and learning anywhere.' (Field notes, Wylde Green)

"The big advantage of the Tablets [compared with laptops] is their size and portability. They make the management of classroom space much easier. If a table of four children are each using a Tablet there is still room on the table for workbooks etc." (ICT facilitator, St Willibrord's)

It is widely recognised that using laptops tends to enhance student motivation (eg Trimmel and Bachmann, 2004). There was universal agreement amongst the case study schools that the Tablet PCs had a very substantial impact on student motivation, which many felt exceeded that linked with the use of laptops. In addition there was a strong feeling that these increases in motivation would result in improvements in students' learning outcomes:

'It's early days and it remains to be seen what impact they will have on progress - there is an impact on motivation and if they are motivated and enjoying learning then there is a higher chance that it will affect attainment and progress.' (Field notes, St Peter's)

"What happens in the different locations has become less rigid. The Tablets have enabled a more varied program so boredom related behavioral problems are lessening. Performance/achievements may be increasing because of this - but it's early days." (ICT support officer, Wilmslow)

As we have seen (Section 3.2) having 'ownership' of a Tablet PC made a substantial difference to the quantity of computer use. Inevitably much of this use was in the context of learning about subjects other than IT. Four of the case study schools cited evidence to demonstrate that the Tablet PCs had resulted in improvements in the children's learning across the curriculum, for example:

"In science there was no difference between students with and without Tablets last

year, however the end of year exams showed that students with Tablets generally outperformed those without." (ICT questionnaire, Cornwallis)

"There are year on year tests. On average [in the past] the test results go up by 2 sub-levels, 60% went up by 3 levels last year [when the children had their own Tablet PCs]." (Teacher, St Francis)

Three of these were schools in which the pupils had ownership a Tablet PC. In the fourth the school had a substantial number of Tablet PCs which were used extensively. A fifth school felt that Tablet PCs had had an impact on maths attainment, but were unable to provide data to support this claim. Six of the schools felt that it was too early to be sure whether or not the Tablet PCs were affecting learning outcomes, however, there was a general feeling that Tablet PCs were likely to have a positive impact due to their clear effect on motivation, self-esteem and students' concentration. This view is supported by studies such as the Gulek and Demirtas (2005) longitudinal study of 259 middle school students, which found a positive link between laptop ownership and student learning outcomes.

3.4 Impact on other objectives

There was very little clear data from the case studies about the impact of the Tablet PC on objectives other than learning about IT or using the Tablets PCs to support learning in other areas. The exception to this was in two of the case study schools where they identified that the provision of Tablet PCs had freed up rooms which had previously been used as ICT suites. However, it seems possible that these savings could have been achieved by investing in laptops.

3.5 Improvements in the curriculum and/or pedagogy

3.5.1 Supporting and Extending the curriculum and/or pedagogy

There was extensive evidence within the case studies of the use of Tablet PCs being accompanied by an increased emphasis on 'independent research' and collaborative work. In four of the six primary schools the teachers described how the use of the Tablet PCs and resulted in a move back to 'topic work' (cross curricular work). In one case there was also a move away from timetabled lessons and from the constraints of the literacy and numeracy strategies (in which the government in England specifies what should be taught in minute detail as well as the lesson format that should be used). However, it appeared to the researchers that most of these changes could have been achieved with standard laptops, and that rather than having caused the change the Tablet PCs had been purchased because they fitted in with the approaches that the school wanted to adopt.

Ten of the schools used Tablet PCs with data projectors to enhance whole class teaching. There was substantial evidence that using a Tablet PC with a data projector and Internet access increased the pace of lessons, provided access to a richer range of resources and

altered the dynamic of the session. Using a Tablet PC wirelessly with a data projector was seen as being better and more cost effective than either a laptop and data projector or interactive whiteboard.

"Wireless operation [of a Tablet PC and data projector] was the dream option for the short time that it worked. ... Interactive whiteboards rank second - they work faultlessly and are inspirational for the children. Data projection and screen offer useful visual aids but lack the magnetism of the interactive function." (Head teacher, Green Lane)

The key advantages of a Tablet PC with wireless connection to a data projector over an interactive whiteboard were identified as being:

- The teacher could move around the classroom rather than having to stand at the front, which helped with classroom management
- The Tablet PC (in slate mode) could be passed to children (in a way that was not possible with a laptop) and this caused less disruption than children coming up to the board
- There were no shadows on the board and no-one standing in front of it, so everyone could see what was being displayed more easily
- The positioning of the board on the wall was less problematic, as you did not have to be able to write directly on it
- The cost of a Tablet PC plus data projector is less than the cost of a PC, data projector and interactive whiteboard

3.5.2 Transforming the curriculum and/or pedagogy

There were examples of transformational changes across the case study schools, which often related to the use of the pen input on the Tablet PCs. For example: extending access to the curriculum for children with 'special educational needs' (mentioned in three schools); providing a qualitatively different experience when used for art work (several schools); changing the nature of note taking and the marking of children's work using handwritten notes in Journal or OneNote and Tablet 2005's annotation facility in Office 2003 (several schools).

"For some teachers it has been transformational. For some students, it has completely changed the way they do things. Others find the technological challenges more difficult and therefore I would say it hinders their learning." (Deputy Head, Invicta)

There was also evidence of the Tablet PCs (often with wireless networking) extending

learning outside the classroom, for example: enabling the use of ICT to support learning in spaces where it had not previously been used (seven schools), such as the school field or gym; or enhancing learning on field trips and in students' homes (occurring in three schools and desired by six others).

4 Conclusions

It was clear that introducing Tablet PCs (with the necessary supporting infrastructure such as wireless networking, staff development and support) is costly, complex and often beset with technical problems. However, this is true for any major investment in ICT and many of the same problems would occur if wireless laptops were being introduced rather than Tablet PCs.

Overall the researchers felt that the vast majority of the use of Tablet PCs in the case study schools could have been achieved using laptops, though this view was generally not shared by the schools. There were a small number of areas where the use of Tablet PCs did clearly seem to represent a better option than a laptop or desktop. These included using them wirelessly with a data projector (instead of using an interactive whiteboard) and where mobility and pen input enabled a transformation in practice as described in Section 3.5.2.

In addition, there was a strong feeling across the case study schools, which was shared by the researchers, that Tablet PCs are qualitatively different to other forms of computer in the way that children react to them. Tablet PCs do appear to be more personal and appealing to children than laptops or desktops, which may be due to a combination of their size, form factor, functionality and more intuitive interface (see Section 3.2):

The size and shape of the Tablets encourage empathy with the machine; the children "wrap themselves around them" (ICT coordinator, Queensbury)

It was evident that most of the case study schools were still experimenting with how best to use their Tablet PCs and that as their understanding of how best to use them increases so will the benefits that they provide:

'Even though we've had the Tablets for two years we are still learning and experimenting with them, there's very little guidance out there on the best way to use them.' (Field notes, Queensbury)

Thus, as one might expect, there are no simple answers to the key question of **the extent to which schools should be investing in Tablet PCs in preference to other formats of machine**. The answer depends to a large degree on the match between the technology and the school's objectives and ways of working. However, the evidence from these case studies

does suggest that Tablet PCs do have significant potential, which is perhaps not yet being fully realised:

"Despite problems we are still optimistic that we will recoup on what has been a big investment -there is no going back - they are so much more mobile and the children really like them ...it is always difficult to be a 'lead school' but we knew this and accepted it, we are still convinced that this is a better solution than laptops or an ICT suite but you need to stand by your beliefs and to persevere especially if there are unexpected problems." (Senior Management Team, St Peter's)

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6 Footnotes

- [1] Onscreen tour of a Tablet PC on the Microsoft website <http://www.microsoft.com/windowsxp/tabletpc/evaluation/tours/default.msp>

[2] Birmingham Grid for Learning website, Tablet PC Trials page <http://www.bgfl.org/bgfl/22.cfm?s=22&m=666&p=387,index> (accessed on 14th Sept 2005)

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