The Motivational Effect of ICT on Pupils

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Acknowledgements

Executive Summary

Key findings

- ICT use by pupils and teachers in the case study schools led to positive motivational outcomes, supporting a focus upon learning and the tackling of learning tasks.
- Positive motivational outcomes were most frequently found when ICT was used to support engagement, research, writing and editing, and presentation of work. Where ICT uses supported internal cognitive aspects of learning, for example in the case of secondary design and technology, there were indicators that the motivation arising from the use of ICT was linked to enhancements in some subject specific attainment.
- More positive motivation resulted when ICT use was focused on both teaching and learning, than when ICT was used to support teaching alone.
- Boys and girls were both motivated by uses of ICT. There was evidence that motivation from ICT use positively affected the work patterns of boys so that they worked in similar ways to the persistent pattern of girls.
- Motivation appeared to be independent of ethnic background, but socio-economic background impacted on occasions in terms of limited access or out of school support.
- There were indications that ICT impacted positively upon pupil behaviour inside school, and some impact on their behaviour outside school.

Background to the study

This study was designed to investigate the impacts of information and communication technologies (ICT) on pupil motivation. The aim was to quantify impacts where possible, and to relate impacts to aspects such as learning outcomes, behaviour, school attendance, truancy, wider issues such as crime and anti-social behaviour, and uses of digital content. The study was intended to consider the ways in which teachers could enhance motivational impacts for pupils, especially for those disaffected with traditional forms of learning.

Some examples of motivational impacts of ICT existed already within a wide literature on educational uses and outcomes of ICT in classrooms and out of school settings. The study was designed to build on such examples and investigate the issues in more detail, and to explore ways to quantify motivational impacts and outcomes. A sample of 17 schools from across England, where positive motivational impacts of ICT had been identified by external observers, were selected for detailed study. This included 5 primary, 8 secondary, 2 special schools and 2 Pupil Referral Units (PRUs). The sample was selected in order to cover a range of school phases and types, geographical locations, locality, socio-economic backgrounds, ethnic backgrounds of pupils, and ICT facilities deployed.

The study involved a wide range of data collection during the spring and summer terms 2003 (details can be found in Appendix 1). Interviews were undertaken with a total of 121 head teachers, teachers and classroom assistants, 22 parents, and 126 pupils, as well as 24 youth and community workers, health workers, careers officers and police officers. Observations were undertaken in 33 classrooms, and documentary evidence was collected. Questionnaires were completed by a representative sample of 1,206 pupils on their attitudes to school, learning and motivation. Subsequently, qualitative and quantitative forms of analysis were completed.

Motivation was conceived for this study by considering eight different measures. These measures drew upon existing motivational theory. Most are concerned with reasons that pupils have for engaging in tasks in a school context. These measures are defined briefly in Table 1 following.

Motivational measure	Definition	'Ideal positive' learning profile
learning goal	the reason for engaging in the activity using ICT is the furtherance of personal understanding and competence	high level is desirable
academic efficacy	the degree to which an individual believes they have the capacity to design and execute the courses of action necessary to achieve a particular goal using ICT	high level is desirable
identified regulation	beginning to recognise and share the values that might have been assumed to drive the inducements offered by others to engage in the task using ICT	high level is desirable
intrinsic motivation	the degree to which ICT directly engages the pupil and holds their interest	high level is desirable
performance approach goal	the reason for engaging in the activity using ICT is the pursuit of opportunities to gain positive feedback about one's competence	low level is desirable
performance avoidance goal	the aim of engaging in the activity using ICT is to avoid feedback suggestive of a lack of competence, often achieved by finding ways of not engaging in the task	low level is desirable
external regulation	a willingness to engage in work with ICT because one feels obliged to do so by someone else, probably an authority figure such as a teacher	low level is desirable
amotivation	a lack of understanding of any particular reason for engaging with ICT supported work	low level is desirable

Table 1: Definitions of motivational measures used for the study

These measures of motivation formed the basis of the pupil questionnaire. Pupils were asked to reflect on recent experiences of using ICT in class and to answer questions about their experience. These answers provided scales corresponding to each of the eight motivational measures. The relative strengths of the different type of measure were then analysed to draw conclusions about the types of motivation associated with ICT use.

Motivational impact on learning
The motivational profiles obtained from the quantitative survey demonstrated the existence of a highly positive set of motivational characteristics in the schools in this study. In summary, pupils were characterised, when focusing on working with ICT, by relatively high levels of learning goals and performance approach goals. The analysis of the quantitative data indicated that the forms of motivation arising from ICT use were concerned with learning, rather than a mere completion of tasks. Perceptions of learning within classrooms were particularly strong and showed that pupils perceived their classrooms, when using ICT, to be focused very much on the process of learning, although many pupils demonstrated anxiety regarding the implications of getting things wrong in front of others, the teacher in particular.

The findings suggested that ICT was helping to draw pupils into more positive modes of motivation. ICT appeared to be offering a means for a range of pupils to envisage success. It enabled pupils to see possible end-points for their work, and to recognise that they could work towards these in order to complete work. However, the use of ICT had to be coupled with learning tasks that were appropriate, and where teaching provided a core of focused pointers (such as where to find appropriate sources, and how to select relevant information).

A wide range of motivational impacts of ICT upon pupils were reported in the study. All secondary teachers interviewed indicated that they felt that ICT had a positive impact upon pupils' interest in and attitudes towards school work. They felt that ICT helped pupils to take pride in their work, that it was helpful for coursework, it supported research, that pupils were taking a genuine interest in the quality of their work, and that it was more likely that a task would be completed and on time. Some teachers felt that it did depend upon what was being done, but that interest was stimulated even if sometimes content was not affected.

With a range of ICT equipment, motivational effect did not depend upon motivation related to a single form of ICT. Motivation under these circumstances was often determined by factors concerned with the form of software or learning resource, the hardware, and the teaching

approach taken. It was reported that, within a positive environment, most pupils enjoyed using ICT (1 out of 200 as exceptions were reported in a number of cases). A concern was that motivation would be short term, associated with 'novelty factors' (interest arising from doing something different or new, with reduced impact after a few weeks). Whilst there were indications of novelty factors being involved in some reported instances, pupils also indicated that their interest was maintained over years of use, both in the cases of software such as writing software and in the presentation offered by interactive whiteboards, for example.

Teachers widely reported on motivational impacts arising when pupils could make improvements to the quality of their work, in terms of writing, appearance and presentation. The resources that pupils reported helping them the most were internet resources (largely for research purposes), writing and publishing software (for writing purposes mainly), interactive whiteboards (on every occasion where these were present in the school), and presentational software (often linked to use of interactive whiteboards).

If, as the research suggests, the main focus of teacher interest and drive is upon the aspects most commonly reported as leading to positive motivation (engagement, research, writing and editing, and presentation), then internal cognitive aspects of the learning process (aspects such as reasoning, comparing, analysis, evaluating and conceptualising) are being given less attention overall, and may not be supported positively to the same extents currently by ICT. If this pattern applies widely to practice, then it suggests that teachers are driving uses of ICT to support internalisation (the ways in which ideas and knowledge that are presented can be taken into the mind through the senses) and externalisation processes (the ways in which ideas and knowledge in the mind can be related to others through processes such as speaking and writing) more strongly than internal cognitive processes. Motivational impacts and outcomes of learning in terms of attainment, therefore, if related, might be expected to manifest themselves in a similar way. If attainment is linked to internal cognition, then current practice with ICT will have less impact upon attainment than it does upon other parts of the learning process.

There were some examples of subject-specific uses of ICT where subsequent attainment was reported to have been higher, and those arose most commonly in secondary school design and technology practice. In four secondary schools where use of ICT in design and technology was reported to be leading to improved attainment, teachers reported that the use of ICT had impacts upon the entire design and technology process. The design and technology process within the curriculum makes explicit the ways in which internal cognitive processes need to be considered, that is, the role of gathering ideas, searching and selecting, analysing potential outcomes and implications, producing rough designs, editing and refining, making, and evaluating. These processes are all explicit and focused upon (driven) by teachers supporting pupils in this subject area, and they are also specifically assessed within subject attainment.

Teaching and learning environments
Where ICT use was focused on both teaching and learning (for example, the use of clusters of equipment to support subject learning and interactive whiteboards to support teaching), the potential for impacts upon motivation appeared to be greater than if there was a single focus upon teaching (for example, in a school where ICT courses were run, without any integration of ICT into other subject learning or teaching). Where used effectively, both teachers and pupils reported that the use of interactive whiteboards was motivating. The features that led to motivational impact were concerned with presentational devices (allowing items to be flashed up, or items to be completed), annotation effects, and direct interaction through touch. From a teaching point of view, teachers used these devices to deliver to a whole class, could use the digital content effectively that was available to them, could easily review aspects previously

covered, and could increase the pace of lessons to the extent that pupils were aware of this increased pace.

Teachers reported widely that ICT offered them enhanced resources to support learning through teaching. The levels of interaction, the visual quality of resources, the immediacy, the ability to refresh work and to redo it, were all indicated as ways in which ICT could enhance the range of teaching approaches taken. Teachers with interactive whiteboards said that they used features so that pupils could observe, then talk and question to increasing extents. In some schools, teachers indicated that they were expecting more of pupils as a result of ICT being used – whether this was due to a higher pace in lessons, work being done more quickly, aspects of analysis that could be focused upon to greater extents, or work being completed outside school more effectively.

Impact on behaviour
Behaviour in lessons was reported by pupils as being better in most cases when ICT was used, and worse in only a minority of cases. The vast majority of pupils indicated that they enjoyed using ICT in lessons. The only exceptions were cases where ICT was used only in ICT lessons, and where access to ICT was felt to be limited. Many teachers reported that ICT was supporting independence of pupil learning. The majority of secondary school pupils agreed, but there was a generally more positive response from older pupils in this respect. In terms of attendance, some secondary school pupils reported that ICT had a positive effect upon attendance (their attendance or the attendance of others). Pupils were able to give specific instances where attendance was affected.

Impacts on specific groups of pupils
Different groups of pupils were found to be gaining in different ways from the use of ICT. ICT used in special schools often enabled communication at a basic and fundamental level. For example, some pupils could not communicate with the external world, either at all, or easily, without the use of ICT based access devices. The information aspects of ICT were fundamentally important to other groups, such as those who were gifted and talented. The success of those who had worked with pupils at risk was often due to their ability to use communication aspects initially, then to move on at appropriate times to information use.

Primary and secondary pupils
Broadly similar patterns of motivation were found in both the primary and the secondary sectors. As would have been expected from the general literature on motivation in schools, primary pupils had somewhat more positive motivational profiles. At the primary level there were few influences on motivation from other factors such as school attended, gender, language spoken at home, and the presence of a home computer. At the secondary level, such factors played a more pronounced role. The age related differences found within the secondary sector suggested a positive impact of ICT on learning generally (motivational scores being higher in years 7 to 9 than would be expected generally).

Boys and girls
There were motivational impacts both on boys and on girls. From the questionnaire evidence, overall, there were relatively small gender differences. When these did occur, however, boys tended to demonstrate better profiles. Against a background of findings showing a more general motivational advantage for girls, the findings from this study implied that the use of ICT probably had a greater positive effect on boys, whilst at the same time not disadvantaging girls. This may well be explained by the fact that boys are traditionally thought to work in 'burst' patterns, while girls work in more 'persistent' patterns. ICT appears to be enabling boys to shift in their approaches from 'burst' patterns to more 'persistent' patterns. This being

the case, ICT would not, of course, disadvantage girls.

Pupils from different ethnic backgrounds
There was no evidence that the ethnic or cultural background of pupils within any of the schools visited was having any noticeable effect upon motivational outcomes. However, from the questionnaire data, at secondary school level, pupils with a language other than English had significantly higher scores on all of the motivational measures other than academic efficacy. Overall teachers felt that ethnic background was not a factor affecting motivation with regard to ICT. Although pupils from different socio-economic backgrounds were equally motivated by ICT use, those pupils who had no home access to ICT were sometimes found to be less motivated by ICT initially (they felt the disadvantage of their limitation, and tend to limit their use where their disadvantage could be recognised).

Those disaffected with traditional forms of learning
There was evidence that ICT, used appropriately, helped to motivate pupils who were disaffected with traditional forms of learning. Of the teachers in secondary schools who talked about disaffected children, most felt that pupils who were disaffected in some way (or who were at risk of being disaffected because they were of 'lowest ability') could be supported through the use of ICT. ICT was increasingly seen to be an effective means of supporting pupils in PRUs, given effective interaction with those who were supporting through teaching or mentoring. Youth workers and educational welfare officers reported similar examples of how ICT was being used to support young people at risk.

Beyond school
Most secondary school pupils reported that ICT was positively helping them with homework and many pupils indicated that access to internet resources was particularly important. Pupils reported that they used ICT outside school either at home, or, for a few, in school library facilities, or in a local internet café. Pupils reported that writing was the most common use for ICT outside school, followed by researching, and then playing games. Most pupils felt that their use of ICT outside school affected their confidence or skills inside school and most pupils felt that ICT would be important to their future career or to employment.

A proportion of pupils reported that ICT impacted positively upon their behaviour or the behaviour of others outside school. The forms of positive impact were substantiated by reports from youth and community workers, and police officers. However, not all professionals were aware of how ICT could be used effectively to support groups of young people and limitations were seen in practice. ICT was not extensively used to link groups in all cases where this might lead to more effective support, particularly for those groups working with young people at risk.

Good practice and models of practice
Evidence from this study indicated that when ICT was used in appropriate ways to support positive motivational measures, and to impact upon internal cognitive processes as well as internalisation and externalisation processes, then reports of impacts upon attainment could arise. A major challenge for subject areas will be, therefore, to consider how positive motivational outcomes (such as those in secondary design and technology and the support of disaffected pupils), can be disseminated to and influence other subjects and learning practices.

Introduction

In October 2002, the Department for Education and Skills (DfES) commissioned a study to investigate the motivational effect of information and communication technologies (ICT) on pupils. This report details the findings of that study, and, in the light of those findings, both draws conclusions and offers recommendations to those concerned with the use of ICT for learning and teaching purposes.

The context in which this study is set is concerned with a rapid growth in uses of ICT in education. The ICT in Schools Statistical Bulletins (DfEE, 2000; DfES, 2001; 2002; 2003) indicate that levels of technology are increasing, as well as the diversity of forms of technology. Fulfilling the Potential – Transforming Teaching and Learning through ICT in Schools (DfES, 2003) highlights the need to consider how different forms of technology can be used and applied within specific school contexts to enhance learning and attainment. The Young People and ICT report (2002) indicates that young people outside schools are accessing technology to increasing extents. Recent reports have shown how schools are acquiring and focusing uses of technologies, with laptops (Passey et al., 2000), interactive whiteboards (in mathematics, reported by Passey, 2001b, and in Japanese and Latin, by Denning and Fisher, 2002), and with use of internet and on-line resources (Somekh et al., 2001).

The study reported here was run between November 2002 and October 2003, and has taken evidence from a wide range of sources in a number of schools. It was the intention of this study that learning be considered within a wide social and community context, as well as within an educational context. Evidence for this study has been gathered, therefore, from sources in the wider social and community settings in which education functions. The section on 'Methodological approaches' details the source evidence further, but the findings presented cover examples of practice and outcomes gathered from documentary and literature sources, from head teachers, teachers, classroom assistants and pupils within primary, secondary, and special schools and pupil referral units (PRUs), from parents, youth and community workers, careers and health workers, and educational welfare and police officers.

In considering this breadth, the study has identified findings concerned with motivational effects of ICT upon pupils across a wide learning arena:
- within mainstream schools, across pupil groups that are gifted and talented, that have particular needs, and that are at risk in specific ways.
- within special schools, across pupil groups that are disabled, that have profound as well as emotional difficulties, and that have individual and specific needs.
- in situations where pupils are non-attendees in mainstream schools, who are at risk in terms of career, emotional, behavioural, and criminal activity.
- in situations where pupils learn in a variety of contexts outside mainstream schools, including in the home, in community centres, and in referred centres or colleges.
- in situations where pupils encounter support and intervention from those who are involved not just in teaching, but in mentoring, advising, and providing access to resources and facilities in out of school settings.

Aims and objectives

The main aims of this study were to identify the impact of ICT on pupil motivation and the related impact on learning outcomes, behaviour, school attendance, truancy and wider associated issues such as involvement in crime. It also sought to identify the aspects of ICT that are effective in improving motivation and to investigate how ICT could best be used by teachers within the curriculum to motivate and engage pupils in learning.

The specific objectives were to:
- Investigate the impacts of ICT on the motivation of all pupils, but to identify particular issues relating to specific groups of pupils such as those disaffected with traditional forms of learning, gifted and talented pupils, primary and secondary pupils, boys, girls, pupils with disabilities, from different ethnic groups, and different socio-economic backgrounds.
- Assess the impact of ICT on pupils' interest in and attitudes towards school work, homework and out of school educational activities, and identify any related impact on the quality of their work and attainment.
- Assess the effect of ICT on pupil confidence, behaviour, attendance and associated wider issues such as truancy, crime, and anti-social behaviour.
- Identify good practice examples of the ways in which ICT and digital content have been used effectively to improve pupil motivation.
- Identify the ICT resources and skills used by teachers and pupils which have most influence on the behaviour and learning outcomes of pupils.
- Identify elements of ICT that pupils find useful within the curriculum, whether it is helping them with work in the classroom, homework, or conducting assignments.
- Investigate any developments of partnerships involving ICT beyond the classroom to tackle poor behaviour or improve motivation, and school initiatives to extend out-of-hours work with pupils, for example, whether ICT is used in out-of-hours clubs to tackle these issues.

Some examples of effective ICT practice that were a focus for this study existed already in the literature, but the focus in that literature had not been specifically on motivation. Some examples of impacts of ICT upon motivation existed at an individual pupil level, such as those reported in cases where a laptop was used to help a year 4 pupil cope with red marks on work (Passey et al., 2000), where ICT was used to enhance detail and accuracy of coursework through multiple redrafting and editing (Passey and Williams, 2001), where use of an integrated learning system (ILS) enabled a pupil to begin the reading process where other approaches had previously failed (Passey, 1997), and where motivation was seen to affect whole classes when interactive resources were used on interactive whiteboards (Passey, 2001b). The purpose of this study was to explore motivational impact in more detail, to quantify the extent to which it was happening in practice, and to identify more specifically the qualities of motivation that arose in different situations. Previous research had been undertaken on a smaller scale and was more localised – this study was designed on a larger scale in order to provide results that could be considered more generalisable and therefore inform policy and practice.

Methodological approaches

The methodology used in the study was constructed in linked stages. The first stage was a research review to provide a conceptual framework for undertaking a qualitative and quantitative study of direct practical use. The qualitative study involved case studies in 17 selected schools and interviews with other professionals concerned with youth and community aspects. The quantitative study in selected schools involved a survey of the motivational characteristics of pupils.

The sample of 17 schools and PRUs was selected to cover a wide range of geographical areas, and socio-economic localities across England. Data was gathered across age phases, and across subject areas, in schools where there were recognised instances of good ICT practice. The selection was based upon the researchers' existing knowledge of some schools, but also upon the experience and guidance of others within the field, including advice from personnel in the DfES, Becta, Ofsted, and LEAs.

The 17 schools involved covered:
- geographical regions (the south, south east, south west, London area, Home Counties, East Anglia, Central Midlands, West Midlands, north east, and north west).
- different locations (inner city, urban suburbs, urban, and rural locations).
- different socio-economic backgrounds (mixed socio-economic catchments, high socio-economic catchments, and catchments of social deprivation or high unemployment).
- different proportions of pupils from ethnic minority backgrounds (multi ethnic pupil populations, and predominantly white pupil populations of British origin).
- different phases (the primary phase, the secondary phase, and mixed phases).
- different types of school (junior and infant, mixed and single sex comprehensives, a City Technology College, special schools, and PRUs).
- different forms of technology (laptop sets, computer suites, computer clusters, interactive whiteboards, on-line resource access, and home-school access).

The evidence from the case study schools was gathered from:
- Interviews with 121 head teachers, teachers, and classroom learning assistants.
- Interviews with 126 selected pupils, covering gender, ethnic background, and special interest areas, selected by teachers on the basis of those motivated strongly, neutrally, or negatively by ICT.
- Interviews with 22 parents, where positive or negative motivational effects appeared to have arisen outside as well as inside school.
- Observations of ICT practice in 33 classrooms.
- 1,206 pupil questionnaires on attitudes towards school, learning and motivation.
- Interviews with 24 social workers, youth workers, health workers, careers officers and police officers concerned with school liaison and youth offenders, where there appeared to be a possible link with motivational and behavioural outcomes.
- Documentary evidence on pupil attendance, behaviour, and attainment records.

The evidence base for this study is detailed further in Appendix 1. The evidence gathered was subjected to two main analytical approaches: a qualitative analysis, collating the evidence from the various sources, at school level, class level, pupil level, and motivational category level; and a quantitative analysis, collating evidence from the various sources, quantifying all the aspects identified, and relating these through data base and spreadsheet forms, so that patterns and trends could be identified, and correlation between factors explored.

Pointers from the literature on motivation and ICT

The research literature explored on pupil motivation using ICT was wide, but not necessarily highly detailed, or contained within a conceptual or pragmatic framework to allow 'motivation' to be identified in more exact qualitative or quantitative forms. Although there were many references to motivational effects of ICT upon pupils, motivation was often described in study outcomes in general terms, without considering even the distinctions between intrinsic and extrinsic motivation, between short term and long term motivational effects, or between engagement and enhanced outcome effects. Even though the literature had many references to motivation, few studies had specifically looked at this topic in detail, and none had tied study outcomes to a framework to aid both conceptual and practical understanding supported by both qualitative and quantitative evidence.

The literature on motivation in education has advanced greatly in recent years. This has enabled more sophisticated concepts concerned with motivation in educational contexts to be developed. There are many aspects of current thinking about the nature of motivational processes within a school context, but the impact of this on evaluations within education has so far been relatively slight, with motivation generally being conceptualised in a relatively unsophisticated manner. A framework developed by Rogers (2002) links motivation of pupils to other concepts such as teacher expectations and teacher self-efficacy. Crucially this framework is cast within concerns around school improvement. Other studies clarify the importance of interest (Lore, Krapp and Baumert, 1998), intrinsic motivation (and its limits) (Csikszentimihalyi, Rathunde and Whalen, 1993), pupils' sense of control over their work (Ryan and Deci, 2000), and varying conceptions held by teachers and pupils alike, of the nature of ability (Dweck, 1999).

The ICT and education literature offered a range of study outcomes and findings over more than a decade that identified motivational effects as being an important outcome and benefit. An early study for the DES reported motivational effects as an important outcome within the original ImpacT study (Watson, ed., 1993). More specific studies into motivational effects were undertaken for NCET by Cox (1997) and Denning (1997). Whilst these two studies identified motivational outcomes and benefits for pupils, the relationship between forms of technology and forms of motivation were not strongly explored. However, motivational effects arising from specific forms of technology were identified in, for example, the ILS studies (NCET, 1994; NCET, 1996; Wood, 1998), the Superhighways evaluation (Scrimshaw, 1997), the Anytime Anywhere Learning (AAL) study reports (Rockman et al., 1997; Passey et al., 2000; Passey, 2001a), and the development of interactive content for Year 7 pupils, such as that in mathematics (Passey, 2001b), and in Latin and Japanese (Denning and Fisher, 2002). Studies by Becta (2000, 2001a, 2001b) have indicated the enhanced attainment that uses of ICT can bring to schools and to pupils, and a part of this was the recognition of motivational effect. More specific findings have emerged as a result of the ImpaCT 2 study (DfES, 2001a), the Pathfinder evaluation study (Somekh et al., 2001), and the Home ICT and School study (DfES, 2001b). The ImpaCT2 report (Harrison et al., 2002) provided an indicative gain for each subject at Key Stage 4 (GCSE) when ICT was characterised as either 'high' or 'low'. As the report said, "in all subjects investigated the pupils characterised as high ICT users outperformed, on average, low ICT users". The report went on to say that, "In the case of design and technology, the subject with the highest reported level of use of ICT, differences in favour of higher ICT levels were found to be statistically significant in all analyses".

Theoretical models of motivation

The model of motivation used in this study involves four key elements, which are explored further here: goals; interest; conceptions of ability; and intrinsic motivation.

Goals: Pupils will have reasons for engaging in the work they undertake. These reasons are rarely as simple as "I am doing this because my teacher told me to". Research (Smith, Rogers and Tomlinson, 2003; Eccles and Wigfield, 2002) has identified three principle types of motivational goals:

- Learning goals: in which the prime reason for engaging in the activity is the furtherance of personal understanding and competence.
- Performance approach goals: in which the principle reason for engaging in the activity is the pursuit of opportunities to gain positive feedback about one's competence (as distinct from enhancing it).
- Performance avoidance goals: in which the principle aim is to avoid feedback suggestive of a lack of competence – often achieved by finding ways of not engaging in the task.

Classroom environments can influence the goals adopted by pupils who work within them.

Interest: The ability of forms of ICT to capture pupil interest is clear. However, interest can be defined in two different ways:

- Situational interest: in which elements of the situation grab the interest of participants. To some degree, the interest remains dependent upon the continuing situational influence.
- Personal interest: in which a disposition on the part of the individual to pursue the activity in question is assumed.

Situational interest is more likely to develop into personal interest under situations where relatively high levels of personal control are able to develop. The key here is to disentangle any effects of ICT in creating situational interest from those that enable the development of personal interest. In the context of the measures employed in this study, the best conditions for the development of personal interest will be obtained when intrinsic motivation, identified regulation and learning goals are all relatively high.

Conceptions of ability: Of growing importance in the motivational literature (Dweck, 1999) is the distinction between entity and incremental views of ability.

- An entity view defines ability (at whatever level) as a fixed and stable capacity to carry out related activities. It is believed by the individual in question that it is not possible to perform consistently above one's level of ability nor to increase ability levels.
- The incremental view defines ability (again at any current level) as something that can be developed and enhanced through the application of practice, strategy and effort.

One, of many, consequences of holding an entity view is that unsatisfactory attainment levels (where the standard may be set by oneself or others) can become deeply threatening if the attainment in question is attributed to a lack of ability. As the ability in question cannot be enhanced, it is hard for the pupil to see any acceptable way forward. Pupils can come to anticipate such situations and develop defensive strategies, such as the withdrawal of effort, in order to protect a sense of self-esteem and self-worth. While effective in their immediate aims, such strategies are maladaptive with respect to enhancing performance. It should also be noted that under the incremental view, ability and effort are additive. Extra effort enhances chances of success and also helps to develop ability. Under the entity view, extra effort is often taken to be a sign of lower levels of ability – it is effortless performance that provides the most convincing display of high levels of ability. Should ICT appear to increase effort levels then it is important to be able to determine whether or not this is happening within the

context of generally held incremental views of ability. Although this aspect is not reported on directly in the body of the current report, the entity/incremental distinction is likely to be an important determinant of the other measures used.

Intrinsic motivation: This shares many similarities with personal interest, as it is generally defined as a motivation to undertake an activity for its own sake. While very powerful in its purest form this is rarely experienced in formal learning settings and schools may possibly be advised not to make its creation their prime objective. Rather, motivated activity can be understood in terms of the degree of personal control that an individual has over what they do and how they do it. As self-regulation increases, so the form of motivation developed increasingly comes to share the attributes of high levels of intrinsic motivation. Also important is the development of the capacity to maintain motivation for work when intrinsic motivation is absent.

Useful motivational effects of ICT would indicate an emphasis on activities and classroom environments that encourage learning goals over both types of performance goals, performance approach goals over performance avoidance goals, the use of situational interest (with a caution against reliance on this), self-regulation in order to facilitate the development of individual interest from situational interest, as well as moving an individual towards more intrinsically motivated forms of activity, and the development of classroom environments that will facilitate the belief that ability is incremental rather than an entity. ICT has no "magic" powers to produce such environments but clearly has the capacity to do so.

The same key set of motivational concerns need to be understood in terms of the ways in which they inform and influence teachers' conceptions of motivation. Drawing on work in the field of school effectiveness and school improvement (Macbeath and Mortimore, 2001; Swann and Pratt, 1999; Gray, Reynolds, Fitz-Gibbon and Jesson, 1996), and on the related field of teacher efficacy (Datnow and Castellano, 2000; Goddard, Hoy and Hoy, 2000; Tschannen-Moran, Hoy and Hoy, 1998), the belief that school and teachers can positively influence pupil motivation is vital. In developing a guided and structured approach to the application of ICT to directly influence pupil motivation, via the above factors, the thinking of teachers about the ways in which motivation operates, and the degree to which it might therefore be changed, will also experience pressure to change. A conception of motivation as a collection of currently held beliefs rather than as a fundamental aspect of an individual's personality, is central to the enhancement of teacher efficacy and, thereby, school effectiveness. ICT, used within an appropriate and informed framework, can provide tools that enable the development of these more effective conceptions to take place.

Motivational measures
A key concern for this study has been to consider ways to measure motivational impacts of ICT upon pupils. Qualitative findings from previous studies concerning the use of ICT have identified motivation as both a component and outcome. It has been the purpose of this study to quantify and qualify these findings further. The ways in which motivation has been conceived and measured within this study is based upon a framework (shown in Table 2 following) which identifies eight key motivational measures. A crucial quantitative consideration for the study is how these motivational measures are profiled for different groups of pupils. The table defines each motivational measure used, and indicates how a quantified measure would relate to an 'ideal positive' learning profile or an 'ideal poor' learning profile. "High" and "low" in all cases should be understood as relative terms, each measure assessed relative to the others (shown in Figure 1 following).

Motivational measure	Definition	'Ideal positive' learning profile	'Ideal poor' learning profile
learning goal	the reason for engaging in the activity using ICT is the furtherance of personal understanding and competence	high level is desirable	low level is observed
academic efficacy	the degree to which an individual believes they have the capacity to design and execute the courses of action necessary to achieve a particular goal using ICT	high level is desirable	low level is observed
identified regulation	beginning to recognise and share the values that might have been assumed to drive the inducements offered by others to engage in the task using ICT	high level is desirable	low level is observed
intrinsic motivation	the degree to which ICT directly engages the pupil ands holds their interest	high level is desirable	low level is observed
performance approach goal	the reason for engaging in the activity using ICT is the pursuit of opportunities to gain positive feedback about one's competence	low level is desirable	high level is observed
performance avoidance goal	the aim of engaging in the activity using ICT is to avoid feedback suggestive of a lack of competence, often achieved by finding ways of not engaging in the task	low level is desirable	high level is observed
external regulation	a willingness to engage in work with ICT because one feels obliged to do so by someone else, probably an authority figure such as a teacher. One may recognise but not in anyway share the reasons why the other wants this	low level is desirable	high level is observed
amotivation	a lack of any particular reason for engaging with ICT supported work. There is no internal reason for wanting to engage in the work, and while others have told you that you must do it, it is not clear why	low level is desirable	high level is observed

Table 2: 'Ideal' motivational profiles related to definitions of motivational measure
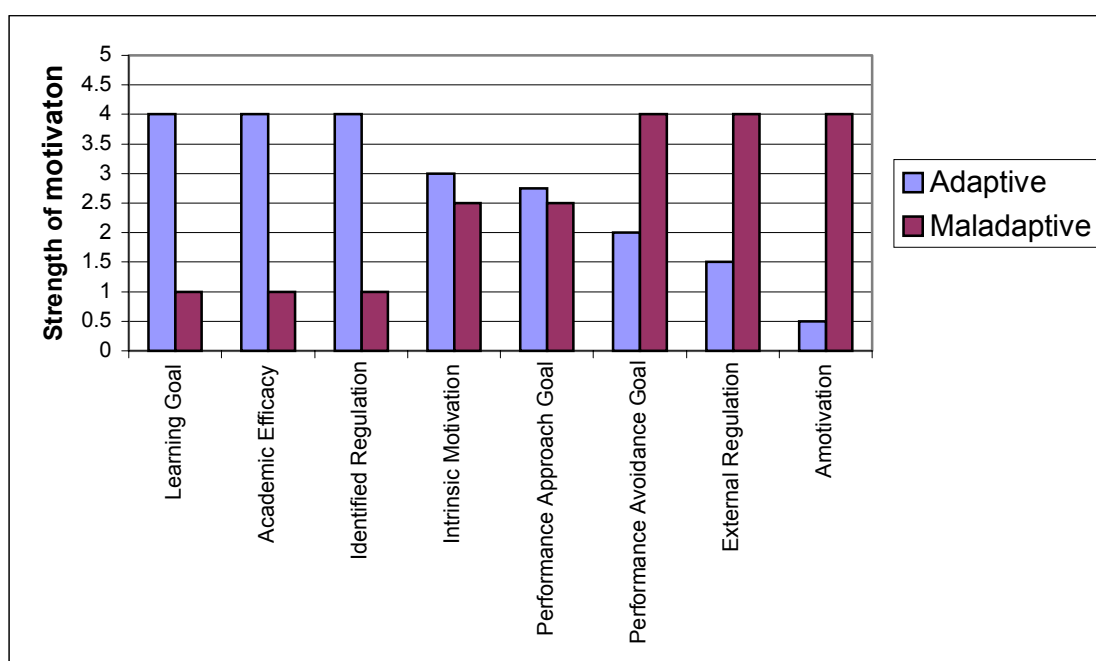
Figure 1: 'Ideal' motivational measures showing 'good' and 'poor' profiles

In addition to the above, pupils should ideally perceive their classrooms to be highly learning focused and to have a relatively low performance (sharing as well as competing) culture. These two dimensions are believed to be independent of each other (a classroom may be perceived to have a high learning and a high performance focus). A variety of combinations are possible and more than one can provide a 'good' motivational environment for given pupils.

The motivational measures were quantified in the study by using pupil responses to specifically designed questionnaires, comprised of two main sections. One section was

concerned with directly assessable attitudes towards the use of ICT in and around the school context. The focus in this section was upon assessing pupil opinions regarding the ways in which ICT might or might not influence their enjoyment of and engagement with work. The main categories of measure employed are set out here.

Motivational goals: Goal theory has identified three important motivational goals: learning goals, performance approach goals, and performance avoidance goals. To assess these issues, adapted versions of the Patterns of Adaptive Learning Scales (PALS) were used. Initially developed in Michigan, USA (Midgley, Maehr, Hicks, Roeser, Urdan, Anderman, Kaplan, Arunkumar and Middleton, 1997), these scales have been well researched and widely used. Adaptations used were relatively minor for secondary pupils, but more extensive for younger pupils. Three versions were produced, one for pupils in secondary schools, one for pupils in years 5 and 6 in primary schools, and one for pupils below year 5. The latter version was substantially abbreviated and should be regarded as offering indicative data only.

Perception of classroom learning environments: Again this involved adaptations of PALS scales as described above. These measures of the perception of classroom environments are closely related to the measures of goals described above. However, the emphasis here is on what the pupil perceives to be wanted and valued in a specific classroom rather than for their own personal commitments. Two such measures were employed. One assesses the degree to which the classroom is seen to provide a learning environment (one that might encourage learning goals), while the other assesses the perception of a performance related environment.

One final scale adapted from PALS was a measure of academic efficacy. Academic efficacy is defined as the degree to which an individual believes they have the capacity to design and execute the courses of action necessary to achieve a particular goal. It is not then a simple measure of perceived ability. Ability can be believed to be high, but academic efficacy remains low if, for example, a pupil is unclear as to what is expected of them, or has little idea as to how to apply their ability to the task in hand.

A further set of motivational measures were adopted from the work of Deci and Ryan (2002) to help assess the degree of self-control and intrinsic motivation experienced by pupils when they were engaged with work in ICT. These items in the questionnaires were used to assess five motivational characteristics, intrinsic motivation to work with ICT, external regulation, identified regulation (although fully self-determined learning is often difficult to assess, particularly amongst younger people, and has not therefore been included directly in this study), amotivation, and conceptions of ability. The latter is based on work by Dweck (1999), and the degree to which pupils believe that ability is either fixed (the entity view) or capable of change and development (the incremental view) is assessed here. The choices pupils make for tasks offering either challenge or ease of completion as a further assessment of beliefs about the nature of ability are also assessed.

Motivational impact on learning

Key findings
- Pupils and teachers in this sample of schools widely reported that using ICT has positive motivational impacts upon learning. The forms of motivation identified are supporting positive pupil commitment to a desire to learn and to undertake learning activities.
- Pupils and teachers recognised that some aspects of quality of work are improving when ICT is used, that attitudes towards school work and homework are often more positive, and that pupil confidence and abilities to perform learning tasks are often enhanced.
- Some teachers in some schools recognise that their expectations of pupils are rising since using ICT and from the motivations arising from use. Pupil expectations are also rising.
- A small number of teachers reported that motivation arising from the use of ICT is having an impact upon attainment. This is particularly the case where pupils have difficulty with motor control and writing skills. In many specific subjects this is difficult to quantify, but there are indicators in secondary design and technology which suggest that improvements in attainment can occur when using ICT under particular conditions.
- To maximise motivational impact, ICT needs to be used in subject specific ways and to be embedded in teaching and learning.

This study does not attempt to compare learning undertaken with and without ICT. The approach taken considers motivational profiles in schools chosen as exemplars of effective ICT practice and compares these with hypothetical good and poor motivational profiles derived from previous research. The motivational profiles from all pupils in the survey, in secondary and in primary schools separately, are shown in Figures 2 and 3 following.

Motivational Profile Secondary Pupils
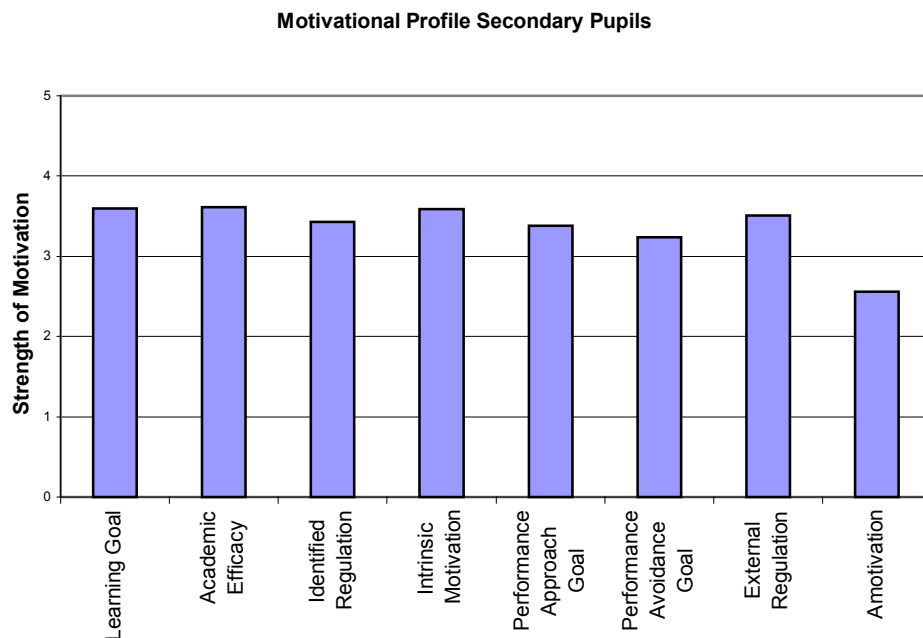
Figure 2: The motivational profile of all secondary school pupils in the study (n=788)

Motivational Profile Primary Pupils
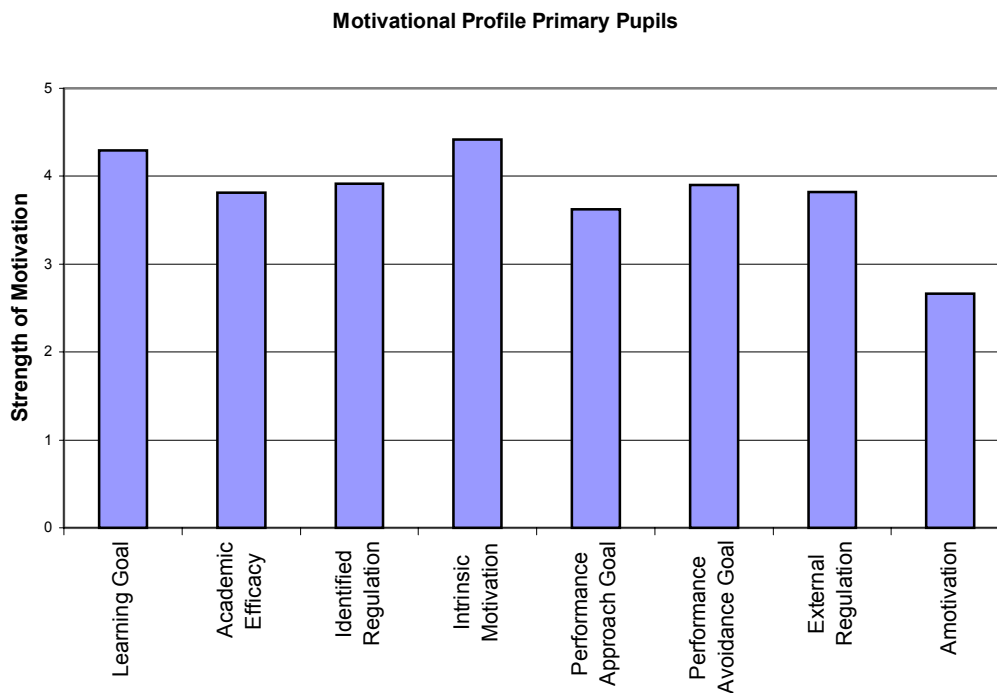
Figure 3: The motivational profile of all primary school pupils in the study (n=418)

The motivational profiles obtained from the quantitative survey demonstrate the existence of a highly positive set of motivational characteristics in the schools in this study. In summary, pupils are characterised, when focusing on working with ICT, by relatively high levels of learning goals and performance approach goals. The analysis of the quantitative data indicates that the forms of motivation arising from ICT use are concerned with learning, rather than a mere completion of tasks. Perceptions of learning within classrooms are particularly strong and show that pupils perceive their classrooms, when using ICT, to be focused very much on the process of learning. Levels of academic efficacy (beliefs in having learning strategies available) are at a high level. A slight cautionary note should be made when looking at performance avoidance goals, for while they are lower than performance approach goals, on average, this difference is not that great. Relatively high levels of performance avoidance goals indicate an anxiety on the part of pupils regarding the implications of getting things wrong in front of others, the teacher in particular.

There are some interesting associations between the various motivational measures and the more direct assessments of attitudes towards the use of ICT. Those who reported finding work with ICT more interesting show positive correlations with a range of positive motivational indicators. Of particular note is a high positive correlation with identified regulation. This indicates that interest in working with ICT is closely associated with a perception that the work is of value in itself. By contrast, external regulation, engaging in the work because one has to, does not correlate with finding school work with ICT more interesting. Those who find that ICT makes work more interesting are being drawn into a value system in which the work undertaken with ICT is being valued. There are clearly implications regarding which work is selected by teachers and supported by the uses of ICT.

Pupils were asked to say how interesting they found all of their school work. By contrasting the ratings given by each pupil, it is possible to calculate the extent to which ICT adds to interest. This new variable (ICT support) is indicative of the extent to which pupils find work with ICT more interesting than work in general. Those who show the greatest gain in interest

when ICT is introduced are found to be less likely to be learning motivated, to have high levels of performance approach goals and to be lower on identified regulation. In other words, those who are generally more interested in <u>all</u> school work might be said to have a somewhat more positive set of motivational characteristics. Taken together, this set of findings suggests that ICT is helping to supplement motivational patterns and is then helping to draw pupils into more positive modes of motivation. ICT appeared to be offering a means for a range of pupils to be able to view success. It enabled pupils to see possible end-points for their work, and to recognise that they could work towards these in order to complete work. It was clear that the use of ICT had to be coupled with learning tasks that were appropriate, and where teaching was providing a core of focused pointers (for example, research activities needed to be coupled for some pupils with pointers of where to find appropriate sources, how to view their validity and bias, and how to select pieces of information of relevance and pertinence).

Quality of work
The findings and conclusions from this study have been drawn from a selected range of schools, where ICT is used in positive ways, often widely across the school. This fact should be recognised and used as a framing context when reading the contents of this report. The outcomes reported here do not arise largely from previously unexplored uses of ICT; they arise from well considered approaches where the variety of tools that ICT offers are applied within curriculum, subject, inside school, and outside school situations, and where pupils are encouraged to apply the use of ICT to support learning. Findings suggest that where pupil ICT use is encouraged by teachers to tackle the needs of learning, pupils recognise the value that ICT brings, they are motivated not just by using the ICT but also by the outcomes in learning that they observe, and are motivated to engage with learning tasks more. A key feature that pupils and teachers recognise is that the quality of work is enhanced when ICT is used.

Teachers in the study widely reported on motivational impacts arising through the use of ICT, since pupils could make improvements to the quality of their work, in terms of writing, appearance and presentation. Teachers reported that ICT helped presentation (reported by 5 primary and 14 secondary school teachers), and helped particularly those whose hand writing was poor (reported by 4 primary and 7 secondary school teachers). Fewer teachers reported that ICT helped pupils to see punctuation and other mistakes (although 2 secondary school teachers indicated that problems were not picked up in other languages). ICT meant that some work could be done which otherwise could not be done, such as visual elements of geography. It also helped to engage pupils, helped to widen their vocabulary, improved the quality of engagement because the pace of lessons was faster, enabled children to explore things in greater depth, allowed for redrafting, affected coursework positively, and supported revision, especially by boys, using revision web-sites. These observations were supported by classroom assistants who reported enhanced quality of presentation, and effects on writing. They also noted the importance of ICT in helping pupils to take more responsibility for their work, and improving their ability to communicate. Parents who commented on the quality of their child's work were largely positive (13 out of 15), saying that spelling was better, layout was better, their child took more pride in their work, project work was better, their child could change and improve things and actually took the trouble to do this, and that it was easy for them to access necessary information on the internet.

The importance of the variety of resources that ICT brought to pupil use was emphasised by some teachers. Reports from classroom assistants and parents also indicated the breadth of uses as being important in terms of motivational outcomes. For example, one teacher said, "*They [pupils] are merging CAD and other packages. They are cutting and pasting, word processing, using databases*". Pupils often reported that the variety of uses of ICT was

important to them, and that motivation arose from this variety rather than from the use of a single item of software or hardware. This point is considered later in more detail.

All primary pupils and 71 out of the 78 secondary school pupils who were interviewed felt that the quality of their work was improved when they used ICT. None of the pupils felt their work was worse when using ICT. The fact that pupils felt that their work was of better quality was certainly likely to be an important factor in their interest in school work, but the range of reported benefits in terms of quality was concerned largely with presentation rather than subject content. Some primary school pupils indicated that hand writing, correcting mistakes and neatness were the features that were positively affected. Most secondary school pupils thought their work looked better when word processed, and that it was neater. They indicated that their work was 'written straight' and that they did not need to format, or write with a ruler. Some indicated that ICT made it easier to edit work, and that in terms of writing, it could improve the structure of sentences.

All secondary school pupils interviewed (78 in total) felt that ICT had a positive impact upon presentation. Primary school pupils indicated that presentation was helped, particularly in terms of hand writing, neatness, being able to choose colour, backgrounds and borders, and being able to select pictures rather than having to draw. Some comments indicated that pupils also felt that there were positive impacts upon organisation of work, with inclusion of page numbers for example. However, some pupils indicated that it was sometimes better to do titles by hand – to gain a 'Stone Age' look for example.

The relationship of quality to better marks was explored in pupil interviews. Some pupils reported that they believed that the use of ICT was helping them to get better marks in their work, but that this concerned specific aspects of their work, such as presentation, rather than necessarily to overall enhancements in all aspects of the subject. Other pupils reported that their interest in subject learning was enhanced, but they did not think that they were gaining higher marks as a result.

Most secondary school pupils interviewed (67 out of 78) thought they did get better marks when using ICT. Fewer primary school pupils (6 out of 33) thought that they got better marks using ICT. Pupils generally felt that they got better marks because the presentation was neater, and that it was easier for teachers to read it. Pupils reported that some teachers told them that they could get better marks if they used computers to do homework, and some pupils reported that they had better marks as a result.

In some cases, the enhanced quality of work was specifically assessed within the subject, such as presentational qualities within design and technology. In this case ICT can impact directly upon aspects that are assessed. Marks from work using ICT were linked to the reward systems within some schools, and these schools indicated that they ensured that their reward system included a review of ICT work. In one school where stickers were used to record 'good' work, pupils put these on their sweaters when the work was done using ICT, so that everyone got to see them (which they enjoyed more). However, some teachers asked pupils not to use ICT for some work, and some pupils indicated that only work in books was marked.

Pupils were generally able to relate quality of work to the use of specific technologies. Some pupils reported that use of interactive whiteboards could increase the pace of lessons, that they felt that they were learning more, and learning more effectively. One mathematics lesson with year 9 pupils observed, for example, was conducted at a fast pace – the attention of all was maintained. The technologies used in the classroom were an interactive whiteboard run from a teacher's laptop, and a set of voting devices that the pupils used. All pupils who had a

device with an even number sat on the right hand side and those with odd numbers on the left (all the devices were numbered and the teacher could track which pupils got the answers to questions right or wrong). The teacher displayed a set of plotted co-ordinates on the interactive whiteboard with 4 statements underneath, only one of which was correct in relation to the example shown. The pupils had to use the buttons on their devices to select the correct answer. A bar chart then appeared on the interactive whiteboard which showed the percentage of the class getting the correct answer. This caused quite a lot of excitement when it was found that most had got it right. The teacher put up a number of further examples. The teacher kept the pace high and encouraged pupils to get a better class 'score' each time to get the bar chart higher ('*83% got it right – not enough!*'). They reached 96.7% which meant that only one pupil gave the wrong answer. No-one was allowed to shout out the answers. Eventually, the pupils managed 100% correct and repeated this for the last example. There was a very high level of engagement with the task – all pupils were very involved – but, importantly, as a whole group who wanted to get to 100%, they were not competing against each other.

Quality of work with ICT can relate to specific forms of work. Secondary school pupils in years 10 to 13 reported that they used ICT a great deal for coursework. They indicated that the ICT enabled them to work more easily, to redraft, to be more creative, and to work faster and more neatly. In a small number of cases pupils indicated that access to ICT at home was a factor involved in deciding whether coursework was done using ICT. Of 15 parents who commented on whether their children got better marks when they used ICT, 5 felt their marks were better. Greater detail in terms of checking work, and more information which was carefully chosen were highlighted as reasons for the improvements. Motivation in these situations can be related to home access and support as well as to school access and support.

A question that will arise for many readers of this report may be concerned with the so called "digital divide", a concern about unequal access to ICT at home as well as at school. The questionnaire asked pupils whether they had access to a computer at home. The results showed very clearly that most did have home access at some level (90% of secondary pupils indicated that they did have access, and so did 76% of primary pupils). The precise nature of this access, clearly, varied quite substantially from one home to another. Not all home computers, for example, were connected to the internet and the degree to which any pupil actually got access to a home computer also varied. Some schools in the sample have needed to address issues concerned with a lack of ICT at home for some pupils. For example, one teacher reported, "*we can now set research problems and activities involving finding images for homework because they have access to ICT at school. One lunchtime is set aside per week for each year group in the learning resource centre. Homework with ICT is mainly set for the upper school*".

Attitudes towards school work
The impact of ICT upon motivation in terms of pupils' enhanced positive attitudes towards school work was being recognised within the schools studied. Head teachers in these schools indicated that the reasons for shifts in pupils' attitudes were due to the impact of ICT upon the quality of their work, the fact that the internet could offer them access to significant resources, that ICT could enable learning to be much more inclusive and could enable their own expectations to rise. In addition, a combination of good teaching, effective behaviour management, and rising expectation on behalf of the teachers could lead to rising standards. Head teachers felt that ICT could motivate at the individual pupil level, even though use might be at a group or class level, and that ICT could open up more opportunities than any other individual means could offer.

Head teachers felt that the following key elements of ICT use have impacted upon pupils' interest in and attitudes towards learning:

o the impact of ICT upon school ethos as a whole.
o the impact of ICT in areas of presentation that could lead to enhanced attainment year on year.
o the aim for perfection through redrafting that could be gained for coursework.
o the impact that ICT could have on the inclusiveness of pupil participation, enabling some pupils to do things that they could not otherwise do.
o the impact of ICT access at school and at home upon the ability of pupils to work increasingly independently.
o the impact of ICT upon boys to enable them to attain at the same levels as girls.
o the impact of presentational software in enabling communication by pupils to groups such as business and company personnel, enhancing their abilities to speak, addressing the frustrations of inabilities or lack of confidence in speaking.

Teachers in the study offered a range of reasons why they felt that ICT was having a positive motivational impact upon pupils' attitudes to school work. Of the teachers interviewed, all secondary school teachers and all except one primary school teacher indicated that they felt that ICT had a positive impact upon pupils' interest in and attitudes towards school work. The teachers reported that they felt that ICT was helping pupils to access their work more, to research more, to bring the mundane to life, and to bring interaction to their work. Teachers felt that ICT helped pupils to take pride in their work, that it was helpful for coursework, that pupils were taking a genuine interest in the quality of their work, and that it was more likely that a task would be completed and handed in on time. Some teachers indicated that pupils could fulfil a task and complete it effectively without the teacher having to go over and over it with them.

The ability to be able to recognise a realistic end point was reported by some teachers as being important. Some teachers felt that it did depend upon what was being done, but that interest was stimulated even if sometimes content was not affected. The teachers talked about 'a new depth visually and orally', the ease of reading what had been written using ICT, and opportunities for pupils to look outside their immediate environment. Teachers reported higher levels of engagement, with pupils sitting and concentrating for longer. Teachers reported that pupils were using some software for self-checking, so that it was encouraging them to be more independent. Teachers reported that pupils were more responsive, talked about their work more, both to the teacher and to each other, that there was more challenge in the work, and a keenness to finish work.

Classroom assistants supported these views. They highlighted the range of activities that could be done, such as drawing, painting, writing, as well as the ways in which pupils' individual interests were integrated more with school work. Of 17 parents who commented, 3 said that the internet was preferred to the use of text books only, 3 said that pupils could make more decisions about work, and select from a wider range of material, 2 said that ICT made things more interactive than a paper medium, 2 said that concentration was better with the interactive whiteboard, and individual parents commented that boys could present work much better, that pupils enjoyed the faster pace of lessons, and that pupils could access work (websites) at home that they had done in school. It was clear from these responses that the value of ICT was being recognised by parents, as well as by classroom assistants, teachers, and pupils themselves.

Making lessons more interesting
Pupils were asked directly whether ICT made lessons more interesting. Of the 78 secondary pupils interviewed, 74 reported that they felt that lessons were more interesting as a result of using ICT, and only 1 pupil felt that they were not more interesting. It should be noted that these responses cover the range of ICT across the study, the use of ICT suites, as well as interactive whiteboards, clusters of computers, and laptops. These responses were not age related or gender related. Some secondary school pupils referred to the fact that ICT made lessons more interesting because they did not have to write as much, but others indicated that learning potential was enhanced. For example, "*the internet helps you understand more*", "*you can experiment and change things*", and "*it makes it easier as things don't get 'rubbed off' if you don't write them down fast enough*". Some pupils indicated that their emotional state was also being affected in terms of interest – "*I don't like maths very much and it's just that doing the things on the whiteboard actually makes it more fun 'cos it makes you more keen to work*", and "*it gives you an opportunity to express yourself better*". Some pupils, however, felt that it was frustrating when things went wrong, and for this reason their interest was not stimulated in the same way. Interest levels were related here to reliability and functionality of the ICT. All 33 primary school pupils interviewed thought that ICT made lessons more interesting. Some referred to the 'games' that they could play, while others referred to the interest arising from the use of the keyboard, being able to hear through speakers, being able to move things around, and being able to see things better.

Homework
Impacts of ICT upon homework were reported upon positively by teachers in some schools (particularly the secondary schools). Some teachers reported that lessons were more concerned with preparing pupils to undertake learning activities, and that the completion of the activities was increasingly happening outside lessons (sometimes at home). Primary school teachers indicated that they felt that ICT was supporting pupils with their homework, but that this depended on whether they had a computer at home (6 teachers reported that they might not under these circumstances encourage use), and that some pupils find things on the internet but do not always read it or rewrite in their own words (reported by 5 teachers).

Secondary school teachers indicated more positively that ICT was supporting pupils with their homework. They reported that pupils wanted to do homework more when they could use ICT or word processing (reported by 14 teachers), that email supported coursework and homework completion, even when pupils were off ill or on holiday (reported by 12 teachers), that email enabled pupils to ask for help with homework (reported by 2 teachers), and that pupils could use web-sites or revision web-sites for extension work (reported by 2 teachers). Parents' views supported the largely positive views of teachers. Of 11 parents who commented, 9 felt that ICT was having a positive impact, and only 1 parent felt that it had a negative effect.

Parents indicated that the way in which homework was done had completely changed as a result of using ICT. They reported that that work was started sooner and completed more quickly, but was neater, of better quality as it met the child's expectations more, that research use was high, and that what had been set for homework could be checked on the school web-site. Pupil views were also positive. The vast majority (74 out of 78 secondary school pupils) indicated that they felt that ICT was helping with homework. Many secondary school pupils indicated that access to internet resources was particularly helpful and important.

Pupil confidence
Enhanced confidence resulting from ICT use and subsequent motivation was reported by teachers and pupils. Enhanced confidence related to 'lower ability' pupils was reported fairly

widely; pupils were reported to gain confidence because they could do things and show things they had not been able to do before, that they could explore more, and share ideas with others. Head teachers reported that pupils were gaining confidence as a result of using ICT, irrespective of age, gender, or needs. They reported that quality of output affected everyone across the entire ability range, that pupils could redo things, and this legitimised the making of mistakes. These views were supported by primary and secondary school teachers, classroom assistants and by parents. In addition, these groups reported different forms of confidence, in terms of tackling tasks and trying things out leading to higher self-esteem (reported by 15 secondary and 2 primary school teachers). They reported confidence increasing due to the quality of work or its presentation, particularly for those of lower ability or with special educational needs (reported by 11 secondary school teachers), and due to their abilities to use ICT more (reported by 7 secondary and 2 primary school teachers). They also reported confidence increasing in terms of enhanced pupil independence (reported by 3 parents), pupils taking time and working at their own pace (reported by 2 primary school teachers), being able to show what they had achieved (reported by 2 primary school teachers and 5 parents), and in terms of giving oral presentations such as those when using presentational software (reported by 2 secondary school teachers and 3 parents), and confidence arising when teaching another child (reported by 1 primary school teacher and 1 parent). Some teachers (2 secondary school teachers) referred to the importance of the internet in building confidence, and to the vocational nature of the work that could be undertaken.

Pupils were asked directly about whether they felt that ICT had any effect in terms of their confidence. Most secondary school pupils (60 out of 78) reported that they felt more confident when using ICT. Many secondary school pupils indicated that they felt more confident in their abilities to handle the work they had to tackle. Of the 33 primary school pupils, 22 reported that they felt more confident about their work when using ICT. They felt that it helped with thinking, writing, making things neater, and being able to check aspects such as spelling.

These observations are supported by the motivational profiles gained from the quantitative survey. In these profiles, the measure of academic efficacy is generally high and indicates that in this larger sample, pupils are confident that they can attempt work, including the more difficult work, that they are asked to perform with ICT.

Independence of pupil learning
Many teachers reported that ICT was supporting independence of pupil learning. However, only a few schools appeared to have considered what this implies in terms of an overall strategy or approach to the curriculum across the school, what needs to be taught about ICT, and when, in order to support pupil independence in this respect. Head teachers reported that ICT was supporting independence of learning in terms of the many pupils who accessed web sites to do homework, research and revision, for example. It also helped the many pupils who used ICT without any external support and the pupils who worked at their own pace and outside lessons. It did this through the opportunities that ICT provided in supporting talking, writing, engagement and exploration.

These views were supported by teachers. Primary school teachers felt that ICT was supporting an independence of pupil learning through their use of templates for example (reported by 7 teachers), that pupils were far less reluctant to ask for help and to share information (reported by 3 teachers), they were independent in terms of searching but not in terms of subject matter (reported by 2 teachers), that programs gave feedback that pupils could act on, and that competition elements from software helped. Secondary school teachers felt that ICT was

supporting an independence of pupil learning, adding that more pupils were now completing more work, and the barrier of having to rewrite had been taken away. One teacher said, "*they believe they are more independent, so they become more independent*", while another teacher said, "*they also learn from each other. It's like having 2 teachers in the class*". All classroom assistants reported that ICT supported an independence of learning. The ability of pupils with poor motor skills to draw straight lines, and to develop mouse control, the ability of ICT to support spelling and writing, the fact that some pupils could now be left to work on their own for the first time, the fact that there were opportunities for pupils to join in activities more, and that access to leisure was extended, were all highlighted. Of the parents who commented, 12 parents indicated that independence was supported by ICT, in terms of research, and with checking grammar and spelling.

Pupils who were interviewed were asked whether they felt that using ICT enabled them to be more independent in terms of learning. The majority of secondary school pupils (66 out of 78) indicated that they felt ICT use did enable them to be more independent, but there was a generally more positive response from year 10 to year 13 pupils in this respect. Some pupils indicated that the teacher was not needed in the same way, "*Yes, you don't need the teacher as much, the computer has its own experience*", while others indicated that ownership of learning was enhanced, "*You can feel you are getting involved in learning. You have found it yourself*". However, some pupils indicated that background IT skills were needed, "*Yes, unless you don't know how to do something*". Primary school pupils reported positively about feeling independent when using ICT, only qualifying their responses in 4 cases where they felt that this happened on some occasions only. Primary school pupils indicated that they could ask pupils when they got stuck (rather than having to ask a teacher), that they could read their own writing better, use more resources to find answers, and got distracted less.

The motivational profiles from the pupil questionnaires lend some support to these expressed views, but with a slight cautionary note. Pupils generally show relatively high levels of intrinsic motivation and identified regulation. Both of these are indicative of the development of self-regulated approaches to learning. However, across the sample as a whole, and particularly in the primary sector, levels of external regulation are often relatively high, indicating that pupils do see themselves as engaging in work with ICT in order to meet someone else's requirements. Meanwhile, however, the low levels of amotivation show that pupils are aware of why their teachers are asking them to do this. This is an important step towards self-regulation and encourages the view that ICT use can develop a more independent motivational stance. These effects may well arise from the differences between samples – the motivational profiles include all pupils in the surveyed classes, whereas expressed views arise from a teacher selected sample.

Impact on attainment
The study looked at whether there was any relationship between motivation arising from ICT, and attainment. The picture that emerged is mixed, but there are some indications that there are positive impacts of motivation arising from ICT use on attainment. Teachers differed in their views in some respects, but this could be related to the abilities of pupils in their classes, and the ways that they used ICT. Some teachers were unsure whether attainment was improved as a result of motivation from ICT (6 primary and 12 secondary teachers). Others indicated that for some pupils with specific difficulties it was now possible to measure their attainment better or even for the first time (reported by special school teachers generally, 2 primary and 2 secondary school teachers). One secondary school teacher indicated that this latter situation could affect up to 33 pupils out of a school of 1000 pupils.

Some teachers felt that attainment was being enhanced due to the reinforcement and practice that ICT afforded (reported by 3 primary and 3 secondary school teachers), due to pupils being able to remember more, through better delivery via an interactive whiteboard, through an increase in knowledge, or work being arranged in a different way (each reported by 1 teacher). Reports of enhanced attainment were limited, in mathematics in the case of 1 primary school teacher, in a range of subject areas in the case of 9 secondary school teachers, in coursework in the case of 7 secondary school teachers, and with the disaffected in the case of 1 secondary school teacher. Having sufficient ICT access to enable enhancements in attainment was noted as a need by 1 primary school teacher. A few classroom assistants in primary schools reported that use of practice programs was helping some pupils to improve on their marks, in spelling, for example. Of the 15 parents who commented on attainment, 5 felt their children were getting better marks because they were more likely to check their work carefully, to include more detail in their work, and that they chose and selected material far more effectively.

Target setting
The role of target setting was reported by some teachers as being an important element in terms of shifts towards higher attainment levels. For example, one teacher said, "*The assessment role of ICT is a crucial element. All coursework is recorded on spreadsheets. Pupils are always trying to improve on their past grades. Near the end of courses pupils are told exactly where they are. The majority try really hard, it's within their power to do something. It really works. Each member of staff will enter their own data and pupils will be able to see where they are in terms of progress*".

Teacher expectation
In terms of raising attainment, the importance of teacher expectation as a factor was summarised by one head teacher who said, "*standards in school have risen steadily in recent years (from 1996 onwards). It's very difficult to say that's due to one reason – for me it's a combination of good teaching, developments in behaviour management, expectation – expectation is absolutely crucial. Using ICT for teaching has definitely contributed towards raising standards because of the multi-sensory approach, the different styles of teaching, the different styles of learning. IT is allowing teachers to use tools that make their life easier*".

Teacher expectations can be associated with approaches that are adopted by a school as a whole. For example, in a primary school which adopted a whole school approach, where substantive training and professional development was available, with classroom based equipment and some interactive whiteboard technology, teachers said of higher expectations of pupils, "*absolutely, yes*", "*helps to support it*", while in a primary school which adopted a central IT facility with teaching undertaken by the ICT co-ordinator, teachers said, "*not sure*", "*no*". Similar patterns were identified in the secondary schools involved in the study. For example, in secondary schools which adopted a whole school approach, with substantive support at subject department levels, with head teacher and senior management support, teachers said, "*yes, we do naturally without noticing it*", "*have higher expectations of their being able to use ICT*", "*we are able to push more and more, especially with the use of email*", "*pupils themselves have higher expectation of themselves*", "*would predict higher grades for boys with using an animation program*", "*higher expectations of gifted and more able pupils to do mathematics problems independently*", and "*more expected from lower ability in terms of presentation and accuracy*". Higher expectations on the part of teachers are reflected in the positive attitudes shown by pupils towards several aspects of ICT use. These data are summarised in Tables 6 and 7. Pupils reported greater concentration, more attention, better understanding and a belief that they would gain better marks when using ICT to support

their work. Such positive pupil responses can provide positive feedback to teachers which will sustain their higher expectations of pupils.

Learning processes
Overall, teachers and pupils across the primary and secondary school sectors reported that ICT has a motivational impact on particular learning activities:
o   engagement (the visual and kinaesthetic forms of the ICT are engaging pupils to greater extents, as is the auditory form to some extent also).
o   research (the ability to search and select from a much wider range of resources including those which are more visually based, and more interactive in nature).
o   writing and editing (the ICT offers pupils ways to commit ideas more readily and widely, and enables editing to far greater extents than was possible on paper).
o   presentation (ICT enables pupils to present work well, no matter what limitations are placed on this by paper and hand methods).

It is clear that teacher motivation and interest in the potential of ICT upon aspects of learning is driving outcomes within classrooms (although some pupils take further the uses of ICT that impact upon learning within their home or outside environments). Learning processes can be divided into three discrete areas – internalisation (the processes concerned with engagement, attention, and sensory access); internal cognition (the processes concerned with knowledge acquisition, understanding, comprehension, analysis, synthesis, and evaluation); and externalisation (the processes concerned with externalising ideas, through writing, speaking, reporting, or presenting). Taking these three categories, and taking the relative frequencies of these as reported by teachers, support staff, and pupils, in terms of where ICT is felt to have a motivational impact, the balance of focus and impact can be shown diagrammatically by shading (in Figure 4 below). The categories that are most often described in terms of motivational impact are internalisation and externalisation. Aspects of internal cognition are related far less. If the main focus of teacher interest and drive follows this pattern, then the internal cognitive aspects of the learning process are likely to be given less attention overall, and may not be supported positively to the same extents currently by ICT.

Internalisation (engagement, etc.)	Internal cognitive processes (such as analysis, evaluation, etc.)	Externalisation (writing, speaking, reporting outcomes of learning)
High teacher motivation and interest with these aspects of learning	Lower teacher motivation and interest in applying ICT to these aspects of learning	High teacher motivation and interest with these aspects of learning

Figure 4: Relative reported levels of motivation related to categories of learning processes

If this picture applies widely to practice, then it suggests that teachers are driving the uses of ICT in internalisation and externalisation processes more strongly than the uses of ICT in internal cognitive processes. Motivational impacts and outcomes of learning therefore, if related, might be expected to manifest themselves similarly.

Design and technology
This situation would be expected to be different if the ICT was applicable and being applied by teachers to particular subject learning processes and needs. There were some examples reported where this appeared to be happening, and these arose in secondary school design and technology practice. In five of the eight secondary schools studied, use of ICT in design and technology were considered to be leading to improved attainment. It was notable that teachers reported that the use of ICT had impacts upon the entire design and technology process. It

should be noted that the design and technology curriculum in these schools made explicit the ways in which internal cognitive processes needed to be considered. The role of gathering ideas, searching and selecting, analysing potential outcomes and implications, producing rough designs, editing and refining, making, and evaluation, were all explicit and focused upon (driven) by teachers with appropriate ICT.

The study looked in depth at the design and technology curriculum and its outcomes in four of the secondary schools involved. The curriculum in all four schools had parallel features, and the outcomes in all four schools showed the same trend. Common features found in the case of the four schools were:

o   equipment was deployed across the department, with computer access within the food, textiles, resistant materials, graphics, and control/electronics areas.
o   computer access was available through desktop or laptop machines within workshops in each topic area, and interactive whiteboards were used for teaching.
o   each area within design and technology used subject specific software, as well as generic software for word processing, presentation, and digital image capture and manipulation.
o   spreadsheets were used by staff to set targets, to monitor, and to track pupil performance, with pupils being aware of the process and seeking to maximise their attainment.
o   word processing and desk top publishing software were used routinely to produce draft and final versions of assignments, from year 10 onwards, and in some cases year 7 onwards.
o   presentational software was used by pupils and teachers to share and present ideas and summaries.
o   email was used generally to send drafts to teachers for comment, from at least year 10 onwards, and in some cases from year 7 onwards.
o   digital cameras and digital image manipulation software were used in all areas from year 7 onwards.
o   Key Stage 3 was divided into modules of work that were covered through separate design and technology areas, with all five areas being covered each year.
o   3D design packages were used routinely from year 7 onwards, to enable pupils to think from a 3D perspective, and to focus upon process and modelling rather than just task.
o   CAD/CAM packages were used routinely to enable design to object to be seen easily.
o   internet and CD-ROMs were used widely for research to match pupil needs and aspirations.
o   embroidery and sewing packages were used within the area of textiles for all pupils.
o   subject specific software included electronic manipulation software, circuit design software, food analysis software and resistant material manipulation software.
o   coursework templates for pupil assignments and as a basis for folders were created with word processing or desk top publishing software, often with headers to highlight the learning needs of each section of the assignment.
o   revision programs were used for certain topics.

These features relate to the motivational measures looked at in the study, and in some cases potentially strongly. The relationship is illustrated in Table 3 following.

Feature	Relationship to motivational measures
equipment was deployed across the design and technology department	performance avoidance goal is reduced, while academic efficacy and intrinsic motivation are supported by deployment and access
computer access was available through desktop or laptop machines within workshops in each topic area	performance avoidance goal is reduced, while academic efficacy and intrinsic motivation are supported by deployment and access
each area within design and technology had subject specific software which was used, as well as generic software for word processing, presentation, and digital image capture and manipulation	learning goal and academic efficacy are supported by the software available, while performance avoidance goal is reduced
spreadsheets were used by staff to set targets, to monitor, and to track pupil performance, with pupils being aware of the process and seeking to maximise their attainment	learning goal and identified regulation are supported
word processing and desk top publishing software was used generally to produce draft and final versions of assignments	academic efficacy and learning goal are supported
presentational software was used by pupils and teachers to share and present ideas and summaries	academic efficacy, learning goal, intrinsic motivation and identified regulation are supported, while amotivation is reduced
email was used generally to send drafts to teachers for comment	academic efficacy, learning goal, intrinsic motivation and identified regulation are supported, while amotivation is reduced
digital cameras and digital image manipulation software were used in all areas from year 7 onwards	academic efficacy is supported
Key Stage 3 was divided into modules of work that was covered through separate design and technology areas, with all five areas being covered each year	intrinsic motivation is potentially supported
3D design packages were used routinely, to enable pupils to think from a 3D perspective, and to focus upon process and modelling rather than just upon task	academic efficacy, learning goal, intrinsic motivation and identified regulation are supported, while amotivation is reduced
CAD/CAM packages were used routinely to enable design to object to be seen easily	academic efficacy, learning goal, intrinsic motivation and identified regulation are supported, while amotivation is reduced
internet and CD-ROMs were used widely for research to match pupil needs and aspirations	intrinsic motivation and academic efficacy are supported
embroidery and sewing packages were used within the area of textiles for all pupils	academic efficacy, learning goal, intrinsic motivation and identified regulation are supported, while amotivation is reduced
subject specific software included electronic manipulation software, circuit design software, food analysis software and resistant material manipulation software	academic efficacy, learning goal, intrinsic motivation and identified regulation are supported, while amotivation is reduced
coursework templates for pupil assignments and as a basis for folders were created in word processing or desk top publishing software, often with headers that highlighted the learning needs	academic efficacy, learning goal, intrinsic motivation and identified regulation are supported, while amotivation is reduced
revision programs were used for certain topics	academic efficacy, learning goal, intrinsic motivation and identified regulation are supported, while amotivation is reduced

Table 3: Relationship of curriculum features to motivational measures

Reports of outcomes of the impact of ICT in each of these four schools was similar. In each case, design and technology results had been seen to increase over time, but in steps, rather than a gradual increase each year. Each step could be associated with particular events, and many of these were ICT related. This is in contrast to the national picture, where a gradual increase has occurred year on year, from 41% A* to C grades in 1995 to 54% A* to C grades in 2003. The schools in this study have increased at an average rate of 16 percentage points

between 1999 and 2003 compared to the national 4 percentage points over the same period. All four schools are also now achieving at much higher levels (76% A* to C on average for 2003) than the national average (54% A* to C for 2003) . A graphical representation of the results of each school is given here (Figure 5).
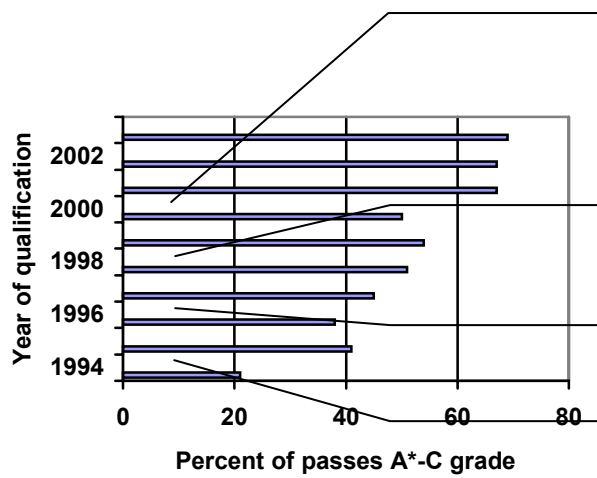
15 PCs on its own network to run a 3D modelling and design package for technology. Coursework became desk-top published for all. Digital camera use was introduced. Laptops were loaned out, and access for all was provided either at home, in the library, or in school. Design and technology offered to all pupils.

Pilot laptop scheme introduced. 6 laptops introduced into technology, for textile work linking embroidery and sewing machines. Plastic moulding machines introduced for resistant materials.

12 PC resource centre established in technology. CAD/CAM milling machine introduced.

School gained specialist technology college status. Campus-wide cable network established, with servers and hubs. 2 PC suites created (but ICT dominated).

School 1
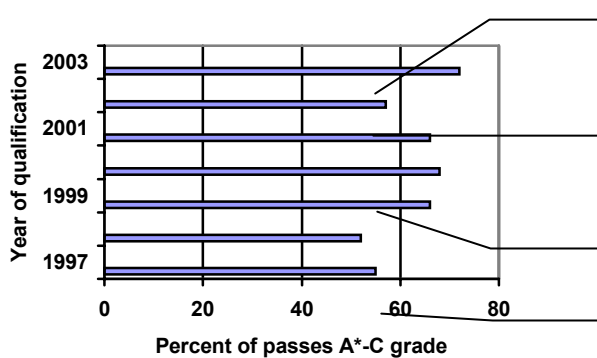
An interactive whiteboard was placed in a workshop. New PC suites replaced the mixture of PC and Macintosh equipment that was accessible previously.

An interactive whiteboard was introduced into food technology. A specialist 3D design and modelling package was introduced.

CAD/CAM equipment introduced. Second ICT room of PCs set up. Laptops available.

ICT room with Macintosh machines.

School 2
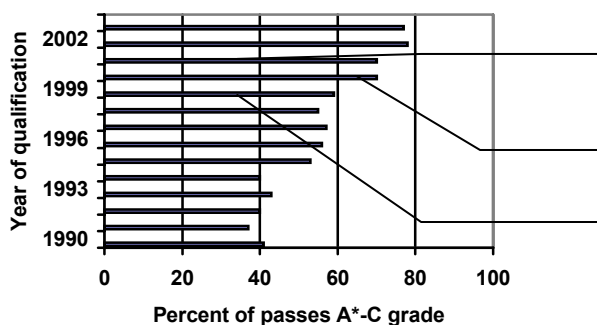
5 computers are put into each topic area, and an interactive whiteboard into a workshop

All pupils are entered for a design and technology subject

Computers introduced into design and technology

School 3
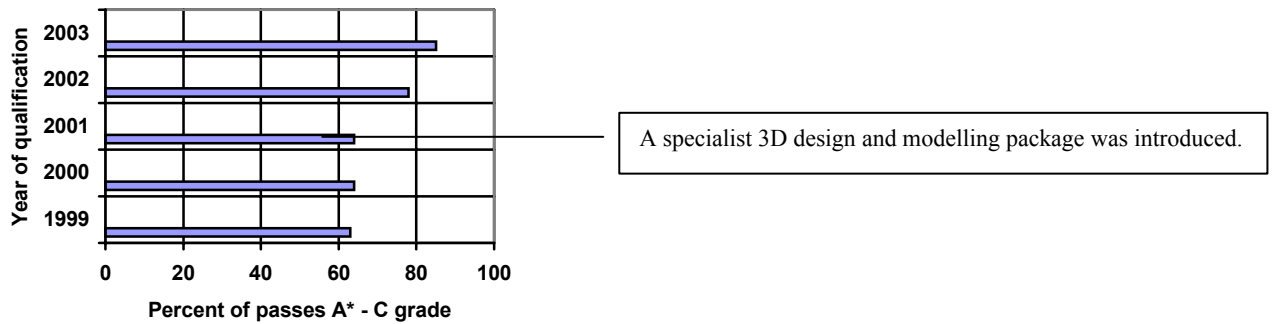
School 4

Figure 5: Annual percentage of A*-C GCSE grades with related departmental ICT changes for 4 schools

In the four schools, ICT is now well embedded within learning and teaching in design and technology. This level of embeddedness has occurred over a period of time. From these four schools, it would appear that the embeddedness of ICT is related to the fact that attainment is at a higher level than when it was partially embedded previously, and higher still than when it was used in more ad hoc ways. The suggestion that integration of ICT into a subject curriculum can lead to enhanced attainment is based upon a small sample of school results and causality cannot be proved. However, if this outcome can be substantiated in other situations, then a future challenge for subject teaching generally will be the need to consider how to embed ICT into the subject curriculum in similar ways as that achieved for design and technology.

Impact on behaviour and attendance

Key findings
- Many teachers reported that pupils are better behaved in lessons when ICT is used, and this is supported by pupil reports. ICT enables pupils to feel more in control, and to feel they can attempt to undertake learning tasks more readily.
- In some cases teachers and pupils reported that the motivational impact of ICT positively affected school attendance. Some teachers and adults associated with education believed that ICT could have some negative effects on attendance and behaviour, but little evidence was found to support these beliefs.
- Some teachers and other professionals believed that from an early age ICT may help to support higher literacy levels, and this could lead to reduced truancy, crime and anti-social behaviour over time.
- Use of mobile technologies was seen in some cases to positively support emotional and social interactions between young people, which was reported to impact positively upon behaviour. Some professionals felt that there are risks to young people associated with unregulated internet access, which could affect behaviour negatively.

Behaviour in lessons

It was widely reported that ICT had a positive motivational impact upon behaviour in lessons. All head teachers who were interviewed commented that ICT had a positive impact on behaviour, that pupils felt more in control, acted in a more adult fashion, that disruptive pupils were not disruptive in lessons using ICT and did not misbehave, and that pupils treated equipment with a lot of respect. Many teachers reported that ICT use led pupils to become more focused and less distracted in lessons. Improved engagement appears to be supported by a number of factors relating to the use of ICT, including forms of sensory engagement, pertinence of materials, being able to use resources where judgments are impartial or neutral, and where pupils can see a realisable end point to the work on which they have embarked. Many classroom assistants reported that behaviour in classrooms was positively affected by ICT. One example offered was of a girl who screamed at everything, but by using a switch, was able to talk, enjoyed the level of communication it provided, and who then stopped screaming.

Some pupils reported that the behaviour of (other) pupils changed noticeably when they used ICT; they reported that their behaviour was better, that they related to other pupils better, and that they were more focused and concentrated for longer periods of time. However, there were other cases reported where pupils indicated that some pupils did not focus upon lesson tasks as much because they could (or were allowed to) be distracted, when internet access was possible, for example. Many secondary school pupils (49 out of 78) reported that behaviour was positively affected, and only 8 reported that it was negatively affected. However, pupils also qualified their responses, particularly those who indicated a neutral or negative impact, by indicating that the teacher had an important part to play in this. About half the primary school pupils reported that behaviour was affected positively when ICT was used (16 out of 33). About one third of primary school pupils interviewed (12 out of 33) indicated that negative behaviour could result from ICT use, but only in 2 cases was behaviour regarded as being worse than in lessons without ICT. Specific pupils were often identified as having worse behaviour, but in the case of secondary school pupils, levels of between 1 and 6 pupils in a class of 25 were often identified as having better behaviour when ICT was used.

Behaviour can be thought of in a number of different ways. A range of perspectives are considered here.

Concentration in lessons

Where ICT was helping concentration, writing and ease of writing were quoted often by secondary school pupils as reasons for enhanced concentration, as well as making lessons 'fun', with sound and colour features drawing attention to topics. Some responses indicated that pupils were wanting to work more as a result of ICT use, with comments such as "*can get extra work to do*", "*want to work more*", and "*can use a range of applications to learn a range of things*". However, some pupils did indicate that concentration could be reduced after a double lesson of ICT use, and where computers had to be shared, concentration was not felt to be enhanced and was sometimes felt to be reduced.

Of the 78 secondary school pupils interviewed, 58 felt that ICT positively helped their concentration, 10 were neutral, and 10 felt they were more distracted. Impacts on concentration were less positively reported by pupils in years 12 and 13, but this could, of course, be due to how ICT was used in lessons, or the fact that pupils were used to working in particular ways. Most primary school pupils also reported that they felt that ICT helped concentration in lessons (only 2 indicated that ICT helped only a little, or that some pupils' concentration did not increase when using ICT). Some pupils indicated that they "*worked really hard when using computers*", or that they "*concentrate more*". Some pupils indicated that the 'fun' aspects helped with concentration, while others referred to better ease of understanding supporting their concentration. Most classroom assistants indicated that pupils concentrated more in lessons when they used ICT. More attention to detail was highlighted, as well as enhanced engagement generally. Of 16 parents who commented on engagement in lessons, 11 thought their children were more engaged when using ICT, and the remainder were not sure. No parents thought their children were less engaged, but reliability of the ICT, and the nature of the task being undertaken were highlighted as factors that affected engagement. Access to a greater range of information on the internet, and willingness to join in lessons with an interactive whiteboard were both positively highlighted.

Commitment to the learning task

Teachers widely reported enhanced commitment to the learning task arising when ICT was used. Head teachers reported that pupils responded positively when outcomes of learning looked professional, that they would put in more time to ensure perfection and detail when this was the case, and that pupils would try harder to meet timing and targets when ICT was involved. However, head teachers commented that pupils needed to be supported in focusing on the important rather than the trivial. They also indicated that pupils responded when ICT enabled the pace of lessons to be enhanced, for example, when interactive whiteboards were used. All except one of the 21 primary school teachers indicated that pupils were more committed when ICT was used. They supported what head teachers said, indicating that pupil attention was far less likely to wander and they were more likely to stay on task longer (reported by 9 teachers), because they wanted to see the end product, and they could see it more using ICT (reported by 3 teachers). They added that being able to work at their own speed helped, and that they got instant results and feedback. Secondary school teachers reported in very similar ways, although they added that pupils used ICT at home a lot, which showed increased commitment, and that those who were slow at typing, or had to share resources, showed no higher commitment to the task. Most classroom assistants reported that pupils were engaged for longer periods of time when using ICT. Of 15 parents commenting on this aspect, 12 felt that their children were engaged for longer periods of time. One parent commented that avid reading and interest in computers were both possible with their children.

Pupils were asked whether they had a better commitment to the learning task when ICT was used. Overall responses were positive, with 68 out of 78 secondary school pupils reporting a

positive effect. A number of secondary school pupils commented that using ICT helped with finishing work. All primary school pupils indicated that they felt that they knew they could undertake school work better when using ICT because they could type more quickly so could remember what they were writing, they could get information from the internet, and could write even though their hand writing might not be very good.

Enjoyment
Enjoyment of using ICT was widely reported by pupils and teachers. Head teachers reported that very few pupils did not enjoy using ICT, that pupils were not seeing ICT as a novelty, that expressions on faces were apparent, even with those who had specific physical difficulties, and that presentation facilities enabled all pupils to feel that they could compete with anyone. When primary school teachers were asked whether pupils enjoyed using ICT, none reported that pupils did not enjoy using ICT, and 17 teachers indicated that pupils very much enjoyed using ICT. A comment from one teacher was, "*Now a lot of the time when you say to children 'What's your favourite subject?' they will actually say maths, English and science. Lots of them enjoy maths, English and science much more not just because of increasing use of ICT in these subjects but they enjoy the lessons much more when ICT is used*". Another teacher gave an example of how enjoyment had supported a specific and important learning outcome, "*A boy last year who was special needs really struggled with his counting and number recognition. They go on an ICT program with bunnies wearing hats. Seeing the bunnies bounce around got him interested and he could count when all other methods had failed*". Only a few secondary school teachers reported that a minority of pupils did not enjoy using ICT. Teachers in a number of schools indicated that 1 pupil in about 200 might not do so. All classroom assistants reported that pupils enjoyed using ICT, either all of them or the vast majority in their experiences. All parents who commented indicated that their children enjoyed using ICT.

The vast majority of secondary school pupils (76 out of 78) indicated that they enjoyed using ICT in lessons. The only exceptions were cases where ICT was used only in ICT lessons, and where access to ICT was felt to be limited. Primary school pupils also reported high levels of enjoyment (no pupils indicated that they did not enjoy using ICT). One pupil said, "*If there's no computing you feel bored. There's no fun. The only fun is outside*".

Negative effects of ICT
From across the entire interview sample, few examples of negative effects of ICT were reported. Head teachers identified a few negative impacts – that technological reliability was important, that pupils could respond negatively to a disparity of resource, both in terms of technology and teaching, across a school, that pupils might not value ICT, which could lead to arrogance and unreasonably high expectations, too much time could be spent on trivial presentation needs, and copying from the internet without reading and selecting could be an issue. Overall 26 negative comments were gathered from interviews with secondary pupils. These comments were not age or gender related. About half of the comments related to technological issues or problems. About one quarter of comments related to distraction, or laziness. The remainder related to a range of issues, some of which were health related, some safety related, and others learning related. The pupils interviewed were clearly aware of many issues, but many reported no problems or issues with uses of ICT. Many primary school pupils could not think of anything that they felt was negative. Comments related to technical problems arising, or to organisational issues, rather than with anything concerned with learning, although some comments were concerned with inappropriate web-sites and concerns about contact with strangers. It is clear from these comments that many problems can be

solved or addressed, given appropriate mechanisms. With other problems there is evidence that positive outcomes can also sometimes result, instead of negative outcomes.

The difficulty in identifying negative aspects of ICT was reflected in the data from the quantitative aspects of the survey. At both primary and secondary level pupils were positive in their endorsements of most statements concerning ICT use. However, there were one or two points for caution. In particular, pupils in both sectors reported that they learned better when they did <u>not</u> have to think about developing new ICT skills. Such skills clearly did have to be developed, but teachers needed to take care to separate out providing the means by which pupils could become proficient at ICT use and the means by which using ICT enhanced learning of other curricula content. A moderate mean level of agreement with the statement that ICT leads to greater 'messing around' should also be noted. On the whole, pupils are not tempted to go off-task through ICT use, but some, on some occasions, are.

Pupil attendance
There is evidence that ICT use is motivating pupils and affecting attendance positively in some lessons. Attendance in lessons when ICT is used was recognised by a few teachers as often being as high as it could possibly be, and there is some indication that attendance practice in primary schools is being affected in some instances. For example, a few teachers indicated that pupils always attended if they knew that ICT would be used, and morning attendance was affected positively when pupils attended a breakfast club using ICT. It is interesting to speculate that this might have a later positive knock-on effect on secondary school attendance. Only two head teachers reported that there had been noticeable impact of ICT upon attendance. One primary school head teacher reported that attendance had risen from 89% to 94% since the introduction of a computerised attendance system.

Most teachers indicated that they did not feel that ICT was having an impact on attendance. However some felt that it did, including 4 teachers who noted that pupils were happier to attend if ICT was used ,1 teacher who felt that there had been a massive effect on the rate of attendance since electronic registration was introduced as it was possible to track pupils, and 1 teacher who said that if ICT was involved, it was fairly certain that pupils would be present, for example, in year 10, in the last lesson of the day. One primary school teacher noted that a Breakfast Club where ICT was used was supporting punctuality through attendance before school.

Secondary school pupils who were interviewed indicated that ICT did have a positive impact on attendance (18 out of 78 reported this). No pupils indicated that ICT was having a negative impact upon attendance (in spite of the fact that some teachers and community workers speculated that it did, for example, by encouraging pupils to stay at home and use ICT, or by their using ICT until late at night). Pupils interviewed were able to give specific instances where attendance was affected. For example, one group said, "*Pupils come into school for an English lesson when in the library. Everybody today came to the science lesson. Punctuality was perfect because ICT was being used*".

Educational welfare officers offered instances where ICT had supported attendance of pupils who did not attend schools regularly. They indicated that alternative ICT courses provided at FE colleges were offering a viable alternative, and that there were high levels of attendance at these courses. One example illustrating this impact was of a boy who had been taken to court because of lack of attendance, but had maintained full attendance when an alternative FE college course involving ICT in a subject area of interest had been provided. Youth workers, careers officers, police officers and parents interviewed were not aware of any instances

where ICT had affected attendance, but comments from youth workers indicated that they believed that issues affecting attendance would be 'deeper' than issues that they felt could be addressed through ICT, although one careers officer indicated that ICT provided the 'spark of motivation' for some pupils who found it difficult to 'get out of bed in the mornings'.

Truancy, crime, and anti-social behaviour
The teachers in the study had not experienced truancy, crime and anti-social behaviour widely, and did not comment generally on the impact of ICT in terms of truancy, crime or anti-social behaviour. No head teachers or teachers gave reports of negative impacts of ICT at an individual pupil level upon truancy, crime or anti-social behaviour. Comments from youth workers, educational welfare officers, careers officers, and police officers provided a more focused perspective on these aspects. One youth inclusion programme mentor felt that pupils at risk of offending (either through anti-social behaviour or crime) could be motivated by ICT, and that this could act as a 'diversionary tool', (but the number this might affect could not be estimated). There was evidence of some pupils going onto unsuitable web-sites deliberately, and youth workers reported concerns about the ability of pupils to avoid face-to-face and social contact when using ICT, although they were aware that pupils were finding alternative ways to communicate by using ICT and offered just as many positive outcomes as potential negative outcomes. One youth inclusion programme mentor was aware that ICT was offering some pupils the opportunity to gain 'time and space' away from poor family situations, and that ICT was by comparison to drug use, drug addiction, anti-social behaviour, or crime, a useful recreational activity. The youth inclusion programme mentor also reported that ICT was enabling a wider interaction between young people and older people, which for many pupils at risk was a beneficial situation.

Truancy
Truancy and attendance are often related issues, and can be difficult to individually isolate at a school level. Few instances of how ICT has impacted upon truancy were reported, but 2 teachers gave reports of positive impacts – one related to the ability to track pupils and to address attendance issues, while the other related to higher levels of pupil attendance at lessons at the end of the day. No head teachers or teachers gave reports of negative impacts of ICT upon truancy. Educational welfare officers were divided in their experiences with regard to seeing examples of ICT related to truancy. One officer reported that ICT had been seen to have a positive effect upon pupils in reducing truancy, while another reported that some pupils were staying at home to play games or to work on a computer. Careers officers knew of few instances of the relationship of ICT to truancy, but one officer related an instance where a computer attendance record had enabled a truancy problem to be solved. In this instance, the computer worked because it was seen by the pupil to provide 'neutral' information. Police officers were largely not aware of any relationship between ICT and truancy.

Anti-social behaviour
Some teachers and some pupils reported that ICT can have a positive impact upon in-school anti-social behaviour. However, some negative behaviour was mentioned, such as the sending of abusive emails, taking of mouse balls, and 'hogging' the computer when the intention is to work in a pair or small group. Some primary school teachers noted that some pupils who were disruptive at play times and lunch times went on the computers instead and this had a calming effect (reported by 4 teachers), and a few secondary school teachers noted that classroom management was easier when ICT was used, and behaviour was improved (reported by 6 teachers), that ICT helped to combat anti-social behaviour (reported by 2 teachers), and that "*there are programs which teach 'relaxation' – linked to colour – which is very helpful*" (reported by 1 teacher).

Secondary school pupils were asked whether using ICT had any effect on behaviour outside school. A proportion of pupils reported that ICT did impact upon behaviour positively outside school (14 out of 78). The forms of positive impact that these pupils reported were substantiated by reports from youth and community workers, and police officers. Secondary school pupils in years 7 to 9 reported impacts on direct communication, while older pupils reported more positively on behavioural impacts upon their work. The value of the communication medium in terms of emotional behaviour was also reported by one group who said, "*you can be involved in a more real discussion over the internet, so you can say everything as feelings are not involved. Feelings are removed or divorced away more when discussing on the internet*". One police officer felt that ICT was supporting more open relationships, and perhaps deeper relationships because of the uses of texting and email. Others found that email was having a beneficial effect in that friendships could be built up from a wider audience, not closed to a single physical group. Others found that text messaging had enabled similar outcomes.

On the other hand, the only known impacts of ICT on anti-social behaviour that were reported by police officers were in terms of uses of abusive email. In terms of family relationships, police officers noted that ICT could provide links to a 'distributed' family more. Police officers also noted the importance of developing family and parenting skills, and literacy skills in some families if ICT was to be used effectively. They indicated that computers should be in open rooms rather than shut into bedrooms, that global access could have far reaching effects, and that mobile telephones could offer levels of security. Parents interviewed were asked whether ICT had impacts on who their children spent time with. Their responses varied, but use of ICT was enabling social interaction through play with sibling(s), family or friends, allowed more social interaction (when living in a remote area), provided more time on their own, but offered 'space', and music and other materials could broaden horizons.

Older pupils indicated that ICT was having an impact upon the numbers of young people on the street, "*definitely reduces numbers of people on the street, as you can talk to your friends on the internet*". Careers officers were not aware of relationships between ICT and anti-social behaviour, but they were aware of examples of how ICT was affecting personal relationships. The impact of text messaging, chat, and email on forming wider friendships was highlighted. In terms of family relationships, two perspectives were highlighted: ICT enabled closer relationships because parents and pupils could work together on the internet; and time spent on games could isolate pupils from families.

In terms of crime, instances are rare in school situations, so the impact of ICT on crime for those in school situations comes from only limited experiences. Educational welfare officers indicated the need for more control over inappropriate web-sites, to avoid problems not just related to access to inappropriate sites, but also to the use of the internet to entice pupils into drug dealing. Actual instances of this impact were offered. On the other hand, one officer reported an instance where a pupil had been helped through an ICT-related course at an FE college to overcome a drugs problem. The importance of communication to pupils who were at risk was recognised, and appropriate uses and access to ICT were being supported through initiatives such as placing computers into homes for looked-after children. In these situations, pupils could become the educators, and use of video cams for communication, for example, were seen as beneficial. The importance of ensuring that computers are not shut away into bedrooms was highlighted by youth and community, and by police officers. ICT has been used in some cases to provide crime awareness resources, and one example of a pupil who had been helped through the use of ICT to reduce activity in crime was reported by a careers officer.

Impact of specific technologies

Key findings
- Where classrooms had interactive whiteboards, teachers widely reported positive motivational impacts on both pupils and themselves in terms of enhanced delivery and pace of lessons, and ease of planning and access to resources.
- The importance of quantity of hardware, access to suitable software and resources, and teaching appropriate to these, were highlighted by teachers generally as being important factors in terms of motivational outcomes.
- Pupils highlighted the use of internet resources and writing software as being motivational. The most commonly reported uses of the internet that motivated pupils were those for research, communication, revision and subject specific uses, and course access.
- Primary and secondary pupils both reported being motivated by uses of ICT in English/ literacy and mathematics. ICT was also particularly motivating to primary pupils in history and to secondary pupils in technology/design and technology.
- Reasons for being motivated by ICT included the visual aspects (including moving imagery and animation), ease of writing, professional outcomes and neatness, and enhanced pace in lessons. Auditory and touch aspects were also important for many pupils.

Specific technologies within the curriculum

ICT is motivating across the curriculum. Teachers, pupils, classroom assistants and parents all indicated this by the experiences they relayed. Secondary school teachers who were interviewed provided the following examples of types of ICT that they felt had the most useful motivational impacts in different subject areas.
- Mathematics - interactive whiteboard, presentational software, ILS, interactive courses
- English - word processing, internet, interactive whiteboard
- Science - interactive whiteboard, simulation and modelling software
- ICT - internet, interactive whiteboard
- Design and technology - 3D design modelling software, CAD/CAM software, email, internet, subject specific software, digital cameras, scanners, interactive whiteboard, presentational software
- Geography - interactive whiteboard
- History - interactive whiteboard
- Modern foreign languages - presentational software, audio cassettes
- Art and design - interactive whiteboard, internet

Parents commented positively on uses of ICT to support English or literacy through hand writing (in 5 cases), mathematics (in 2 cases), and in lessons generally but not in ICT lessons (in 2 cases). In only 2 cases did parents identify ICT lessons specifically, and in both cases felt that their child was not motivated in these lessons.

Primary school pupils who were interviewed identified three subjects most commonly as those where ICT was found to be motivating: mathematics (on 8 occasions); English and literacy (on 6 occasions); and history (on 4 occasions). Three subjects that were commonly given by secondary school pupils as the subjects where ICT supported them most were given for quite different reasons: technology/design and technology was reported (on 15 occasions) because of the uses of ICT for researching, writing, designing, CAD/CAM production, presentation and evaluation opportunities afforded by different forms of ICT; English was reported (on 12 occasions) because of writing opportunities afforded by ICT mainly; and

mathematics was reported (on 8 occasions) because of the visual opportunities afforded through interactive whiteboards, and use of specific software such as spreadsheets. Of the forms of ICT that pupils had used, writing programs were widely reported as being helpful, internet access was reported as supporting research particularly, but also revision, and interactive whiteboards were reported by all pupils who had had contact with them as being useful and motivating. For example, one pupil said, "*IW, I have learned loads from this. It's organised in steps and is done really fast, you can recap on it, it can be shown again and again*". Teachers said that some pupils who do not join in some class activities will join in and respond when they are using an interactive whiteboard. Uses of such technologies are also enabling a greater interaction between pupils and teachers. In some cases pupils as young as year 1 are helping to support staff and other pupils with ICT skills.

Specific ICT lessons do not always cover the generic ICT needs of pupils. Aspects such as how to undertake research effectively on the internet, for example, may either not be included in an ICT curriculum, or might occur at times when it is of limited use to pupils. Internet and on-line access is commonly reported by pupils, teachers and classroom assistants as having motivational and learning impact. The deployment of hardware coupled with access to internet and on-line resources has led to the most commonly reported motivational and learning impacts. Pupils asked about their uses of the internet reported four main forms of use both within schools and outside schools: for research, with educational uses quoted more often than access for general interest purposes (65 examples were quoted, from year 1 onwards); for email and for contacting friends, and for shopping and for games (17 examples were quoted, from year 1 onwards, with some emphasis in years 1 to 6 for accessing games for mathematics); for use of specific programs such as revision programs (7 examples were quoted, but only from year 7 onwards); for access to course materials, to complete coursework, and to contact teachers (5 examples were quoted, but only from year 7 onwards). Classroom assistants pointed out that internet and broadband access enabled a range of different activities to be run concurrently within a classroom. In certain cases the ability to run a session where pupils were working on more than one subject was a clear advantage. Many parents also commented on the value of internet resources for research and revision purposes.

Visual impacts
The vast majority of secondary school pupils (65 out of 78) felt that the visual aspects of ICT were important for their learning, but often for different reasons. The explanations that were given indicated that pupils were not just observing more, but were gaining understanding in many instances. Pupils referred to better understanding and explanations, to being drawn to colour and being able to remember more easily. The importance of the visual aspect to writing was also reported, for example, one boy said, "*When typing I am reading what I am saying, but not when I am hand writing*".

Auditory impacts
Secondary school pupils indicated that some schools suppressed the use of sound (for a range of reasons), but a number who had access to sound did feel that there were learning benefits. The number of positive responses (31 out of 78) suggested that many pupils were supported in their learning through the use of sound.

Impacts of touch and contact
The number of secondary school pupils who reported that touch and contact helped their learning was high (51 out of 78). There were two main features of contact that pupils reported as helping them: contact with the keyboard (and it is notable that girls indicated the value to their learning of being able to make contact through a keyboard, with, for example, one girl

saying, "*It is different with a keyboard. You can type faster than write, so keep up with your thinking instead of interrupting it*", and another girl saying, "*You can feel your progress. The faster you go with the keys, the more you notice progress*"); and the contact potential that an interactive whiteboard offers (such as that through a pen, or direct contact with the screen).

Learning with ICT-based texts
Secondary school pupils who were positive about whether ICT helped them in terms of learning with texts (38 in number) indicated that choice of font and size of text was important, being able to see things more easily on screen, being able to find information more quickly, being able to skim easily, and having helpful prompts on meaning. Different pupils had different preferences, but preferences were not particularly age or gender related. It was also true that pupils were aware of the different benefits of each medium, and that schools needed to be in a position to support pupils with both ICT and paper media with regard to texts.

ICT-based mathematical resources
There were 26 secondary school pupils who were positive that their mathematical learning had been supported through the use of ICT. They indicated that presentations, internet sites, spreadsheets, revision sites, and faster pace using interactive whiteboards all helped. Although a range of pupils did feel that ICT was helping them in terms of mathematical learning, this was a case where the use of ICT was limited often by the form of teaching chosen. Many pupils indicated that ICT was either not used in mathematics lessons regularly, or that teachers chose to use books rather than ICT.

Learning when pupils want
There were 43 secondary school pupils who felt that ICT let them work when they wanted to, outside of lessons. They indicated that outside of school hours, access was sometimes easier at home than at school. The need to book access to computers at school in advance was commented on, and the limitation that could arise when a lot of people were logged onto the internet. It was clear that some classes in some year groups were experiencing limitations that other classes in the same school did not experience. Limited access for some pupils was affecting the motivation that pupils reported.

Learning where pupils want
Of the 78 secondary school pupils interviewed, 24 thought they could use ICT where they wanted, 40 thought they could not, and 14 were not sure. It was clear from the responses that some schools had taken steps to address the issues of access for pupils without ICT at home. However, instances where this had not been addressed were often in more rural settings, where transport was a major limiting factor. In circumstances where schools were not able to support pupils effectively, some communities have begun to address this issue by establishing ICT access within a community centre, for example, but this does not appear to be widespread. Some schools have addressed specific issues using laptops, while others have only addressed issues within the school context, through distributed computers in clusters and resource centres in various locations around the school. The larger number of pupils in years 9 and 10 who reported limited access to a computer at home might indicate a deeper issue for these year groups.

Impacts on collaborative work
Of the 78 secondary school pupils interviewed, 21 felt that ICT supported collaborative work, 28 felt that it did not, and 29 were unsure. The collaborative potential of ICT had not been explored and used to a large extent within secondary school classrooms. Secondary school pupils thought certain ICT skills were needed when using ICT to work with other people.

They felt that ICT could help to speed up certain parts of an activity, that presentational programs worked well in this respect, and that ICT could help to share ideas or understanding. Pupils felt that working in pairs was the most useful practice they had experienced with collaborative learning, but there was a need to listen to each other, to be respectful of each other, and a need for patience and for compromise. Some pupils gave the example of how two pupils could use the blending effects in presentational software to produce a blending of colours in a background as an example of collaboration where arguments about neatest work were avoided.

Organising work
The vast majority of secondary school pupils (72 out of 78) felt that ICT helped them in terms of organising their work. They indicated that using files and folders meant they could put documents in order of date, or work order, that it was harder to lose things in electronic form, that layout was aided, that reminders could be put up, that back-ups could be kept, and that features helped them, such as page numbers being generated easily. A comment from one year 11 pupil summed up many responses offered, when he said, "*You can have folders and back ups. It is not possible with a book. You can't have a back up of a book, can you!*".

Recommendations from pupils to enhance motivation
Pupils were asked what they would recommend to teachers in order to encourage more work or more interest in school work through uses of ICT. Primary school pupils often suggested more use by teachers (but not too much more), and within specific subject areas (literacy, science, history, geography and religious education). They indicated that ICT should be used more for looking things up, for revision, to make work look better, and to make things harder. Secondary school pupils suggested that teachers needed to work together to ensure that files from different subject and topic areas were managed in appropriate folder systems. They felt that ICT use across subject areas should be widened, particularly use of interactive whiteboards, that visual aspects should be enhanced where possible, and they should be involved in creating presentations more. They felt there should be more use of the internet for research, for accessing particular resources, uses of ICT for writing in English lessons, and for creative activities in art. They felt there should be more ICT used for revision activities and that use for coursework should occur in all subjects more routinely. Some suggested that laptop computers should be available to enable access to electronic texts and to offer enhanced access for writing and accessing the internet more generally.

These responses indicate that pupils are able to recognise the value that ICT can bring to them, both in terms of motivation and in terms of direct impacts upon learning. Pupils tended to report these values as though they saw them hand in hand (and this perception is confirmed by the quantitative survey results). Pupils report that they value what is being done in terms of ICT in schools, and as one year 12 boy said, he would like to, "*Say thanks to the teachers. Use of ICT has spurred me on and others. In another school I would have 'dossed about' – use of ICT has been perfect*".

Impact on specific groups of pupils

Key findings

- Motivational impacts of ICT upon learning are broadly similar and positive for both primary and secondary school pupils. Some age related differences have been identified, but these are supportive of existing patterns of engagement to learning generally.
- Quantitative results show a decline in performance avoidance motivation between years 7 and 10, which is contrary to generally observed trends. This suggests that ICT is having a positive motivational impact upon pupils from year 7 onwards in secondary schools.
- Motivational impacts of ICT are positive for both boys and girls. However, there are some differences in terms of greater access to ICT by boys at young ages, and the ways in which ICT affects use. Overall, there appears to be a positive impact upon a 'persistent' pattern of work for boys, with no lowering of outcomes for girls.
- Motivation of pupils with disabilities when ICT is used is widely reported. The impact that ICT has upon communication and the learning potential of pupils with disabilities places access to ICT for these pupils in a special category.
- Motivational impacts of ICT were not found to be related to ethnic group in any schools involved in the study.
- Motivational impacts of ICT were related to socio-economic groups largely in terms of levels of access and understanding of the potential that ICT can offer. A digital divide is related in this way to background understanding in the home and not merely to access.
- ICT was seen to be having positive motivational impacts upon some pupils disaffected with traditional forms of learning. Communication aspects of ICT are important for engaging those at risk, while information aspects of ICT can further learning activity.
- Gifted and talented pupils are being motivated and supported in learning, particularly through the information aspects of ICT. Access to internet and on-line resources is particularly supportive for this group of pupils.

Primary and secondary pupils

Although there are references throughout this report regarding findings for both primary and secondary school pupils, this section considers the implications for a continuity of learning across primary and secondary schools. It also summarises points elsewhere in the report.

Some pupils at very early ages are recognising the value to learning that can arise from uses of particular forms of ICT. Some pupils can discern between the ways that different forms of ICT support their learning; interactive whiteboards being recognised as supporting what and how to learn, the internet being used for extensive research, while direct uses of applications on computers are recognised as supporting processes such as writing and editing. The forms of ICT that pupils report helping them most commonly with learning are the internet (for research purposes), writing and publishing software (for writing and publishing purposes), the interactive whiteboard (for visual, auditory and kinaesthetic reasons), presentational software (for presentation and observation purposes), and CD-ROMs (for research purposes).

When considering motivation within schools, the issue of age relatedness is not simple. When pupils move from year 1 to year 12, they experience a range of shifts which can have dramatic effects upon their motivational levels. Those experiences are not just educationally driven, but arise from social, emotional, cultural, behavioural and physiological sources. The roles that ICT can play in this respect can be significant, since ICT can support aspects of communication as well as information. A range of workers in the youth and community areas believe that ICT often plays a significant role for young people, and that this has a bearing upon motivational impacts that are measurable within school or educational contexts.

From the questionnaire results, broadly similar patterns of motivation were found in both the primary and secondary sectors (refer to Figures 2 and 3 earlier in the report). There were some age related differences, which are explored later in this section. The pattern of motivational goals at the primary level was particularly positive. Research generally shows positive motivational patterns at this age level, with an increased likelihood of less adaptive motivational patterns being observed after the transfer into secondary school. However, it is noteworthy that in this study, learning goals were much higher than performance goals in the primary sector and that classrooms were clearly seen to be focused on the promotion of learning goals. It is possible, of course, for classrooms to be actively engaged in learning through the promotion of performance goals. The evidence from motivation research suggests that the latter, in the long run, will be less effective. Performance structures were low in this sector, but individual performance goals were relatively high and performance avoidance goals were at least as strong as performance approach goals. As with the secondary sector, intrinsic motivation for learning with ICT was high, as were levels of identified regulation. Amotivation was low, as was external regulation. Pupils are typically neither just working because they have to, nor because they are stimulated by the ICT use itself. They are showing an encouraging tendency to develop a set of values that stresses the importance of learning per se and where they see learning activities (rather than the use of ICT) as being something to which they attach a personal value.

Table 4 following shows the results for primary school pupils in years 5 and 6. These are assessed on a 3 point scale (rather than the 5 point scale used for the secondary school pupils).

Question	Mean
Schoolwork with ICT is more interesting	2.69
Work is more fun without ICT	1.50
I pay more attention when lessons involve the use of ICT	2.25
I find all my school work interesting	2.20
Using ICT helps me to choose the best place to start a piece of work	2.40
ICT lets me work whenever I want to	2.15
Work without ICT grasps my attention better	1.73
I get more involved with my work when I don't have to think about new ICT skills	2.01
ICT helps me to understand things better, because I can see examples in pictures, in video or other things that I can look at	2.70
ICT helps me to understand things better because I can listen to examples that are given in sound	2.53
Using ICT makes me keen to go to every lesson	2.35
I mess around more in class when I use ICT	1.49
Using ICT makes me keen to go to school every day	1.99
Using ICT now will be better for my future career and needs	2.49
ICT helps me to finish a piece of work that sometimes would be difficult to finish without it	2.46
ICT makes me want to work more by helping me to make my work look better	2.47
I work better with ICT because I can change things I have already written or done in other ways without making my work look a mess	2.62
ICT helps me to work with other people	2.51
I work better with ICT because it helps me to put my ideas together	2.62
I work better with ICT because it helps me to see things more easily	2.43
Using ICT helps me to get better marks	2.21
I work harder with ICT because it helps with my writing	2.14
I like working with ICT because it helps me work better with other people	2.45
Working with other people when using ICT helps me to learn better	2.47
I like being able to show other people how to do things when I am using ICT	2.53
I can work longer without losing my concentration when using ICT	2.45
If you can work longer with ICT, tell us how much longer. Write your guess as to the number of extra minutes here (e.g. 5, 15 ,30)	31.34

Table 4: Primary pupil questionnaire data (years 5 to 6) (quantified on a 3 point scale, where 3 indicates a high level of agreement)(n=163)

As the above questions were each rated on a three point scale, any mean above 1.5 indicates an overall agreement with the statement. In examining each statement care should be taken to note the 'direction' of the statement as some express negative attitudes towards aspects of ICT use. The pattern of results is generally positive. In the cases of both primary school pupils (in Table 4) and secondary school pupils (shown in Table 5), negatively weighted items show a different pattern of scores, confirming that pupils are not simply responding by ticking the same column in all cases. A direct assessment of attitudes for secondary school pupils towards ICT shows a similarly positive pattern of results (shown in Table 5 below).

Question	Mean
Schoolwork with ICT is more interesting	4.02
Work is more fun without ICT	2.32
I pay more attention when lessons involve the use of ICT	3.47
I find all my school work interesting	2.80
Using ICT helps me to choose the best place to start a piece of work	3.49
ICT lets me work whenever I want to	3.28
Work without ICT grasps my attention better	2.41
I get more involved with my work when I don't have to think about new ICT skills	2.89
ICT helps me to understand things better, because I can see examples in pictures, in video or other things that I can look at	3.82
ICT helps me to understand things better because I can listen to examples that are given in sound	3.49
Using ICT makes me keen to go to every lesson	3.34
I mess around more in class when I use ICT	2.56
Using ICT makes me keen to go to school every day	2.93
ICT will be important to me in the future	4.10
Using ICT now will be better for my future career and needs	4.07
Using ICT helps me to get better marks in my work	3.72
I work harder with ICT because it helps with my writing	3.23
I like working with ICT because it helps me work better with other people	3.30
I like being able to show other people how to do things when I am using ICT	3.60
Working with other people when using ICT helps me to learn better	3.55
I can work longer without losing my concentration when using ICT	3.55
If you can work longer with ICT, tell us how much longer. Write your guess as to the number of extra minutes here (e.g. 5, 15 ,30)	41.39

Table 5: Secondary pupil questionnaire data (quantified on a five point scale, where 5 indicates a high level of agreement)(n=788)

As the above questions were each rated on a five point scale, any mean above 2.5 indicates an overall agreement with the statement. In examining each statement care should be taken to note the 'direction' of the statement as some express negative attitudes towards aspects of ICT use. It is clear from Table 5 that the average response is very positive. ICT is enjoyed and seen to make a valuable contribution to school work. As expected from the general literature on motivation in schools, primary school pupils have somewhat more positive motivational profiles. There are particularly strong perceptions of learning structures within classrooms for primary school pupils and their lower reliance on forms of external motivation. It is also worth noting that both primary and secondary school pupils show relatively high levels of performance avoidance goals. Ideally these goals should be lower in both sectors.

At the primary level there were few influences on motivation from other factors. So the school attended, gender, the year of study (admittedly over a small range), language spoken at home, and the presence of a home computer made no difference to motivational scores. At the secondary level such factors played a more pronounced role. There were significant differences between schools. Those schools that were high on some motivational characteristics tended to be high on most others. It is not clear from the quantitative data alone

whether these differences between schools were a function of school practices in relation to ICT or a function of intake variance. The qualitative findings suggest that emphasis on learning and teaching, approaches to access and deployment, and uses of resources across subject departments are important factors. Age related variations were found within the secondary sector, and these produced a picture that was positive in terms of what it had to say about the potential impact of ICT upon motivation.

From year 7 through to year 10 there was a significant decline in the level of both performance avoidance and perceived performance classroom structure (the extent to which pupils perceive the class as a whole as emphasising the importance of doing better than others, as opposed to focusing on one's own learning). Both of these tended to increase however in year 12. The latter effect can probably be attributed to the pressures of external examinations, which are likely to encourage pupils to emphasise the importance of performing well in comparison to others. However, a main point to note here is that the decline in performance avoidance motivation is contrary to generally observed trends showing less adaptive motivational patterns that tend to increase over the early years of secondary schooling. Levels of performance avoidance could be usefully lowered across the schools surveyed, but the observation of this decline in such motivational factors suggests that the use of ICT might be having positive developmental effects on the pupils at these schools.

In a similar vein, identified regulation shows an age related increase, with the year 12 pupils being significantly higher than those in year 9 (other inter-year comparisons do not produce significant differences). While less marked than the age related changes in some motivational goals, and while less remarkable in relation to background theory and research, the growth in identified regulation is encouraging. Levels of amotivation are lower for year 10 and 12 pupils than for those in years 7 to 9. This is a less remarkable finding as older pupils would be expected to have a clearer sense of personal commitment to their work and be less likely to have no particular reason to engage in the given activity. Taken overall, the age related differences found within the secondary sector are suggestive of a positive impact of ICT on motivation.

The findings indicate that pupils are generally positive in the view they take of ways in which ICT helps them to work effectively with other people. There are some noteworthy relationships between these measures and motivational patterns. Primary school pupils who are positive about the ways in which ICT helps them work with others have higher learning goals. At the secondary level this extends also to identified regulation, intrinsic motivation and, to a lesser extent, academic efficacy and performance approach motivation. Particularly for older pupils, ICT, by helping pupils engage with their colleagues, may be helping in the development of more positive and helpful motivational patterns.

In a similar vein, at secondary school level, positive attitudes to the role that ICT is expected to play in the pupils' futures can be noted. These positive attitudes are positively associated with learning goals, intrinsic motivation, identified regulation and, to a lesser extent, academic efficacy. It is the development of a commitment to learning (learning goals) and to the positive and intrinsic values attached to work engagement, that predict positive attitudes to ICT's role in the future. Pupils are not endorsing ICT because it helps them to perform better than others. In a similar vein, the perception of a learning focus in classrooms (task structure) is positively associated with the importance of ICT in the future. The perception of performance structure in the classroom (an emphasis on being encouraged to do better than others) does not predict the belief that ICT will be important in the future at all. ICT is having a positive effect through its association with a commitment to learning rather than through the encouragement of gaining a competitive edge in school.

Boys and girls

The survey findings show that overall both boys and girls are motivated by ICT. At very early ages some pupils use ICT toys at home, and the use of these, it is felt by some teachers, could relate to motivation towards uses of ICT in school. A lack of ICT toys for girls is felt to be a limiting factor in the motivation that girls have at early ages for ICT, so that differences between impacts of ICT use by boys and girls is being noted in some cases from fairly young ages: boys are regarded as being motivated in different ways from girls, and wanting to gain higher levels of access to ICT; boys are considered to be interested in tasks that are more competitively designed, and of shorter length. Head teachers reported that boys tended to know how to operate software packages before girls. They reported that motivation of boys and girls was the same, that all pupils benefited, but they could benefit in different ways. They reported that boys seemed to be gaining more in certain cases, but girls were not being disadvantaged (this perception is supported by the quantitative results). Of 21 primary school teachers who commented on the motivation of boys compared to girls, their responses are summarised in Table 6 following. The number in brackets represents the number of mentions.

Responses relating to both boys and girls	Responses relating to boys	Responses relating to girls
Just as capable and enthusiastic as each other (11). They might do different things on the computer, but they are just as enthusiastic (3). Differences are down to home access and use, not gender (2).	Boys have more ICT games at home than girls, and they enjoy it more at school too (4). Boys are more eager to use ICT (2). Boys want to do things quickly, while girls are more concerned with presentation (1). Boys play more, while girls write more (1).	Girls tended to need more support in using laptops (2).

Table 6: Primary school teacher comments on motivational impacts of ICT on boys and girls (n=21)

The responses of the 34 secondary school teachers who commented on the motivation of boys compared to girls are summarised in Table 7 following.

Responses relating to both boys and girls	Responses relating to boys	Responses relating to girls
o not a great deal of difference in terms of motivation (9).	o boys are more motivated to use ICT initially (12). o boys tend to want to take short cuts, to write more quickly, to redraft, or even cheat (5). o boys like design packages and presentational detail more (4). o visual presentations appeal more to boys (3). o boys can waste time using ICT (3). o if boys have more access at home this affects their motivation and confidence on the keyboard more (2). o programming and IT courses appeal to boys more (2). o boys can be more creative when using ICT (2). o boys use computer games more, and these are aimed at boys (1). o boys will use ICT to present their work to others more (1). o boys have responded positively to textiles when ICT is used (1). o boys like instant feedback (1). o boys are motivated to finish tasks using ICT (1). o boys like the neutrality of ICT (1).	o girls want to see the value of ICT uses before they use it (3). o girls want to make their work look better (3). o girls like desk top publishing more (1). o girls can become more motivated than boys with uses of ICT (1).

Table 7: Secondary school teacher comments on motivational impacts of ICT on boys and girls (n=34)

Teachers are divided to some extent in their views about the motivational impacts of ICT on girls and boys. A few teachers have found that girls needed more support than boys; boys were noted as being more interested in using ICT than girls in some schools. A few teachers indicated that the difference could be culturally related, for example, that their experience was that boys are encouraged more than girls to ask questions in some ethnic groups – so they felt that some girls were inclined to say 'I don't know what to do'. A few teachers said that a lot of the boys who would not normally be engaged in aspects of a lesson such as an introduction, once using ICT, were immediately attentive. Many teachers noted no differences in the

classroom - both boys and girls were enthusiastic. A few teachers noted that some boys got over excited, while many others indicated the enthusiasm for ICT at school was driven by home access. But interactive whiteboards were a technology where motivation on boys and girls was noted equally. Classroom assistants all reported no differences in the ways ICT motivated boys and girls.

Gender differences in motivational patterns found in the questionnaire samples in relation to work using ICT should be interpreted against the general pattern of gender differences among school pupils. Recent studies have shown a clear 'advantage' for girls in that they are usually found to ascribe to higher levels of learning goals and lower levels of performance goals than is the case for boys. Two different approaches were taken to the analysis of the motivational measures' data. First, a straightforward comparison of the means scores between girls and boys was made on each motivational measure used (shown in Table 8 following). The three point scale used to measure primary school motivation levels was mathematically scaled to a five point scale for this analysis.

Motivational measure	Girls (mean)	Boys (mean)
Learning goal	3.63	3.56
Performance Approach	3.27	3.48
Performance Avoid	3.25	3.24
Task Structure	3.83	3.77
Performance Structure	3.10	3.14
Academic Efficacy	3.56	3.66

Table 8: Mean scores for each motivational measure for boys and for girls of all ages (n=1206)

The data summarised in the above table were subjected to multivariate analysis revealing an overall significant effect for gender. Subsequent univariate analyses showed that the differences for performance approach and academic efficacy were significant. In both cases boys had a higher score. While significant, the differences were small. While girls had a higher score on learning goals (an observation in line with general trends), this difference did not reach statistical significance. Unlike many other studies, this study cannot conclude that girls have stronger learning goals than boys.

The other motivational measures employed here, intrinsic motivation, identified regulation, external regulation and amotivation, did not show any significant gender effects. Taken together these observations suggest that, at secondary level, boys and girls have broadly similar strengths of motivational goals. There was some suggestion that boys felt more confident while engaged with ICT and that they were more likely to welcome the opportunity to demonstrate what they were capable of doing while engaged with ICT. Given the general motivational advantages that girls are often found to have in classrooms, these findings might suggest that ICT is having an 'equalising' effect. On the other hand, claims that boys have a strong advantage over girls when ICT is in use, receive only slight support here.

A second approach to the analysis involved the use of cluster analysis. One aspect of the approach taken in this study has been to employ the notion of motivational profiles. Given that motivation is held to be a multi-dimensional phenomenon, it makes sense to consider the way in which pupils can be described by a combination of motivational characteristics. Eight separate measures of a pupil's own motivational characteristics have been assessed (learning goal, academic efficacy, identified regulation, intrinsic motivation, performance approach goal, performance avoidance goal, external regulation, and amotivation). With each variable assessed separately, there are a very substantial number of possible profiles. One approach to reducing this complexity is through the statistical technique of cluster analysis. All the variables were entered and a search was made for given combinations of score levels that

produced a specified number of clusters. This analysis was carried out and used to shed some further light on the variations between girls and boys in relation to ICT use and motivation. As the primary school data is less reliable than that for secondary pupils (due to shortening of the questionnaire to make it accessible to this age range, and to smaller numbers of questionnaires gathered), this particular analysis for the primary data should be interpreted with caution. The three clusters for the secondary schools are illustrated in Figure 6 following.
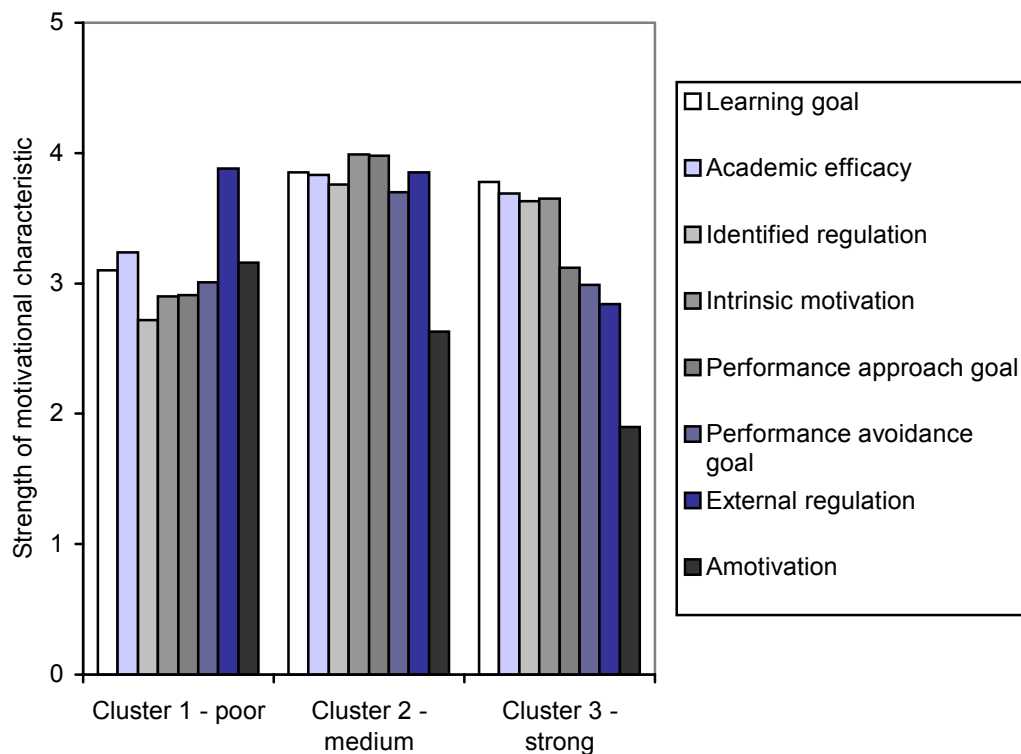
Figure 6: Motivational clusters of secondary school pupil data (with scales rated on a 5 point interval)

The three clusters can be taken as representing the mean scores over the eight factors for the pupils contained within each cluster. Cluster 1 contains 172 pupils, cluster 2 contains 201, and cluster 3 contains 212. Bearing in mind that the relative differences between three identified sub-groupings from a total group of generally well motivated pupils are being considered, the following descriptions can be attached to each cluster.

Cluster 1: This is the relatively weaker pattern of the three. The main indication of this is the relatively high level of external regulation (indicating a willingness to engage in work with ICT because one has been told to) and of amotivation (indicating a lack of any particular reason for engaging with ICT supported work). Other motivational factors are low when compared to the other two clusters.

Cluster 2: This cluster falls someway between the other two. Pupils placed here share high learning goals with high performance goals, intrinsic motivation and efficacy. However, in comparison to cluster 2 they have high levels of external motivation and relatively high levels of amotivation.

Cluster 3: This is the most positive of the three. Learning goals are relatively high, while performance goals are relatively low. At the same time pupils in this cluster have high efficacy, intrinsic motivation and identified regulation. Importantly they also have low levels of external regulation and notably low levels of amotivation.

Broadly similar clusters are found at the primary level as illustrated in Figure 7 following.
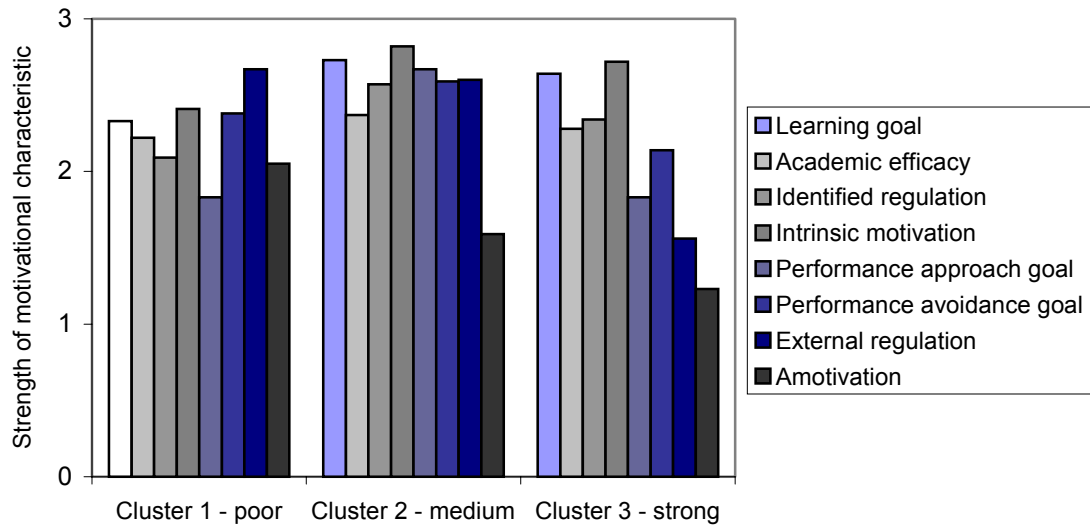
Figure 7: Motivational clusters of primary school pupil data (with scales rated on a 3 point interval)

Interpretation is not quite so clear cut as with secondary school data, but cluster 1 would be the relatively poor cluster due to high levels of external regulation and, in particular, amotivation. The poor cluster also has low performance approach goals. Cluster 3 is probably the strongest due to low external regulation and amotivation and high levels of learning goals, intrinsic motivation and identified regulation.

Comparisons can be made between boys and girls in terms of their representation within these three clusters. There is a significant gender effect here at the secondary level since girls are over-represented in Cluster 1 (the weakest cluster), with a corresponding under-representation in Cluster 2 (the medium group). The proportion found in Cluster 3 (the most positive) is essentially the same for each gender. To illustrate the strength of this effect, of the pupils found in the weakest cluster (Cluster 1) 44% are male and 56% are female. In the intermediate cluster (Cluster 2) 59% are male, while 41% are female. Of the total sample, 51% are male and 49% are female. Figure 8 following shows the percentage of all male and female secondary school pupils found in each cluster
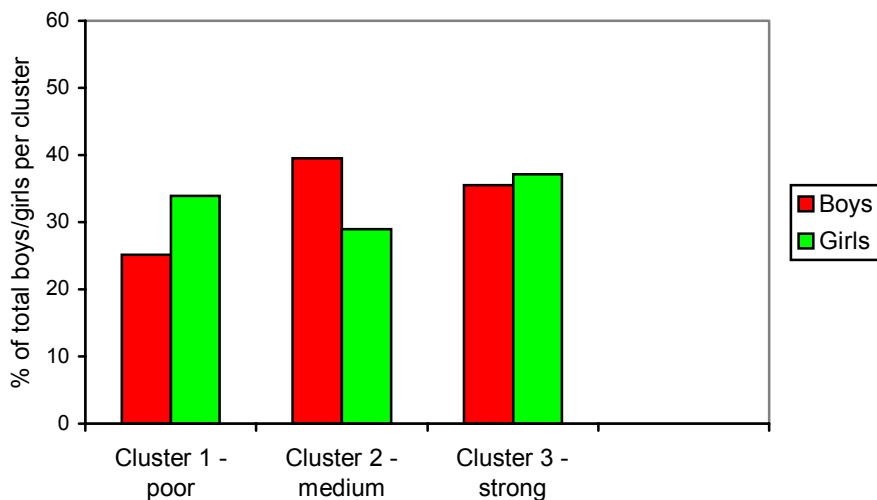
Figure 8: Gender variation in secondary school motivational clusters

The variations in cluster membership are not truly substantial, but while essentially equal proportions of boys and girls show the best motivational pattern, girls who are not in that group are more likely than boys to be found in the poor group. Whilst overall there are relatively small gender differences, when these do occur, boys tend to demonstrate better profiles. Against a background of findings showing a general educational motivational advantage for girls, this implies that the use of ICT probably has a greater positive effect on boys, while at the same time not disadvantaging girls. Recent research studies have tended to show girls as having higher levels of learning goals and therefore being better equipped to maintain effort over longer periods of time. Boys tend to have higher levels of performance approach goals and therefore tend to be better equipped for the more 'dramatic' short burst of effort (for example, in preparing for important examinations). The quantitative findings of this study are borne out by the qualitative findings, which indicate that boys can, through the use of ICT, move in their patterns of work from 'burst' approaches to more 'persistent' approaches.

At the primary school level there are comparable findings as illustrated in Figure 9 following.
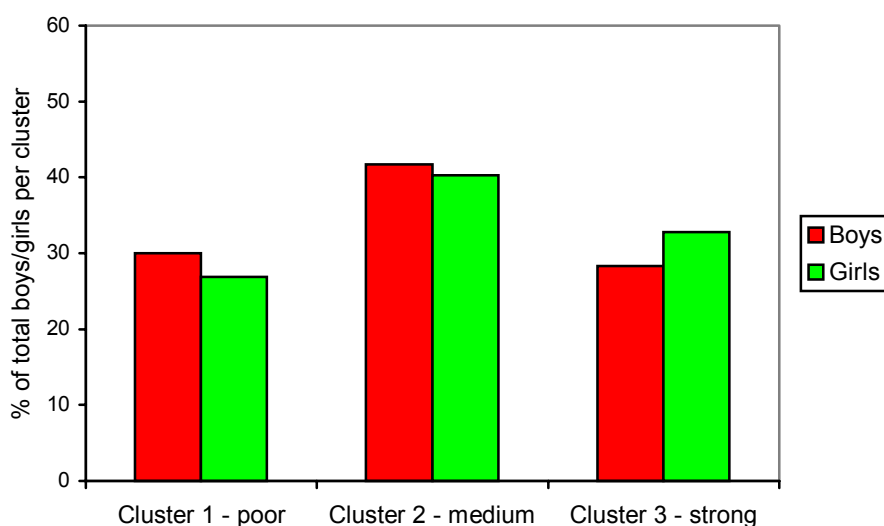
Figure 9: Gender variation in primary school motivational clusters

The differences do not reach statistical significance, and the genders should be regarded as being essentially identical with regard to cluster membership at the primary level.

Pupils from different ethnic groups
Head teachers, teachers and classroom assistants reported widely that there was no difference in interest or motivation arising from ICT with regard to ethnic group, but that having a computer at home could make a difference. The quantitative results indicated that language used at home had no impact upon motivational measures of primary school pupils. Reports from a number of schools suggested that experiences that pupils gain at home can relate to positive motivation towards ICT in schools. Teachers suggested further that any differences that there might be with pupils from ethnic minorities could arise because of impacts at a family level, in terms of home experiences and opportunities, rather than motivational differences being due to cultural differences. It was reported by a small number of teachers that there might be cultural differences between boys and girls in some ethnic minority groups that related to how boys and girls approached the uses of ICT, although this was not confirmed by other teachers in schools where there were sizeable ethnic minority groups. There were some specific instances of differences, such as the Plymouth Brethren, who are

not allowed to use ICT, but pupils can go into lessons where IT is used as a fundamental part of those lessons.

Overall teachers felt that ethnic background was not a factor affecting motivation when using ICT. A head of a learning resource centre who worked in an inner city school with a large number of ethnic minority pupils said, *"the group that stands out are the indigenous white disadvantaged students who don't have a computer at home. They hate computers and ICT"*. This statement is borne out by the quantitative results which indicate that all motivational measures except academic efficacy are significantly higher for those secondary school pupils with a language at home other than English.

Pupils with disabilities
Motivation arising from the use of ICT in special schools and for pupils with disabilities generally is a special case. ICT is used in special schools often to enable communication at a basic and fundamental level. For example, some pupils cannot communicate with the external world, either at all, or easily, without the use of ICT based access devices. When a pupil can recognise communication with the outside world, there is clearly motivation arising. However, the use of ICT is so fundamental in this situation, that without it, no or limited external communication would be possible. In this respect, ICT should be regarded as essential.

Special schools look at how to integrate multi-sensory approaches to a greater extent than happens in some other schools. Sensory rooms are set up in special schools, and these rooms are designed to impact upon visual, auditory, and kinaesthetic senses. More generally, software and internet-based resources for special schools have to be developed with an internalisation of learning approaches much more in mind. Textual, visual, auditory and kinaesthetic aspects of the resources are often fundamental to their bringing about what teachers would regard as any viable motivational impacts.

Specific uses and effects of ICT with pupils with disabilities can be exemplified by considering the practice within an all age special school catering for pupils with profound and multiple learning difficulties (PMLD), severe learning difficulties (SLD), autism and other cases of special needs. The school has 146 pupils on roll, aged 4 to 19 years. The school has two blocks, a Key Stage 1 and 2 block, and a Key Stage 3 and 4 block. Pupils who are post 16 are out of school for 4 days a week, and their curriculum is 90% community based. Morning lessons focus on mathematics and English, and afternoons are based in a 'specialist' room with specialist teachers, including ICT. The school has an ICT room, but there are also ICT facilities in classrooms, the staff room and the library. The ICT room is used by teachers after school, and the ICT teacher supports staff expertise through a range of evening sessions. The head teacher believes that ICT has had a positive impact in the school, and it is the ICT room that has had most impact. Teachers use presentational software for assemblies, and produce pupil friendly resources. The head teacher feels that every pupil can take part when using ICT, and can achieve something, whether it be as the result of pressing a button or talking, so making learning inclusive. It enables some things to be done that could not otherwise be done. All pupils can use ICT to take part, for example, in a play.

No differences are noted in the school between the motivation of girls and boys, but the school has many more boys than girls. The head teacher could not think of anyone who does not like ICT or who cannot use it. ICT lets pupils think about strengths and weaknesses, and pupils stay on task longer than when using traditional forms of paper medium. It is an achievement for some pupils to remember some things from one lesson to another, and ICT is

reported to be enhancing memory to enable recall to greater extents. Some pupils like to help others with ICT, which gives them enhanced self-esteem. In doing more, pupil independence is enhanced. That ICT provides a means to strongly support independence for some pupils is supported by reports from teachers in the special schools and those who work with pupils with special needs generally. Teachers find they can leave some pupils to work on a computer, while they could not leave them to work on other tasks. For some pupils, ICT has had a major impact upon behaviour – they will sit using ICT, but not otherwise. Teachers and classroom assistants have reported that some pupils have been able to make dramatic leaps forward through the use of ICT. For example, pupils with cerebral palsy tend to become demotivated because they try to communicate, but often fail to do so. ICT enables them to communicate, and so motivates them to a great extent. The use of interactive whiteboards is also having impacts, because it offers the ability for pupils to move things around on the board.

ICT enables specific disabilities to be addressed in specific ways. For example, a quadriplegic child uses a knee switch to enable him to write and communicate – in this way, expression is possible, which it would not be otherwise. ICT allows abilities to be displayed that would not otherwise be possible to see. Some pupils may never speak, but they can use language boards, which enables them to express themselves. Poor motor control and autism can be supported through use of trackerballs, and the interactive whiteboard allows pupils with these difficulties to do more than they could on a keyboard. Consequently, teachers believe ICT has made pupils more interested in school work, especially through use of the interactive whiteboard and the internet. Teachers report that the quality of work is enhanced through the use of ICT. Where hand writing was not possible through poor motor skills, then quality is enhanced. It is recognised that pupils value the presentational quality that ICT provides, and they use a spell checker to identify errors and to seek help. ICT affects attainment for many pupils with special needs or disabilities, by enabling pupils to present work with a level of accuracy that allows their work to be recognised and assessed. Consequently, pupils concentrate longer when using a computer, and remain more focused.

It is found generally that behaviour problems do not occur within ICT rooms, as pupils are generally challenged and engaged. Teachers report that they do have higher expectations of pupils, in terms of presentation particularly. Some pupils can do things with ICT that they could not otherwise – so expectations are quite different. ICT enables communication so that pupils can make decisions about their environment. The ICT reported to have the greatest impact on motivation in this school was access technology, interactive whiteboards, roamers, simple video controls, digital cameras, touch screens, and sound programs.

Many teachers reported that children with learning difficulties could 'thrive' on the computer. The impact on pupils who were dyslexic, or who had difficulties with writing, was reported widely by teachers and that impact could affect every subject. Some teachers noted that 'lower ability' children could have top level IT skills; they could read and follow instructions when these were not in purely textual form. Some teachers offered examples of specific effects, such as that of an autistic boy who used ICT, with sounds initially, then managed touch, which was a significant step for him. Careers officers were also able to give examples of instances where ICT had supported pupils with Asperger's syndrome and Down's syndrome. Pupils involved were found to be comfortable with using ICT to the extent that they gained GCSE results.

Pupils from different socio-economic backgrounds
There were no reports from head teachers, teachers, parents, or those who work at a youth and community level that motivation from using ICT is affected by socio-economic background; pupils from different socio-economic groups are equally motivated by using ICT. However, where differences in how effectively pupils could work with ICT were reported, these related to differences in levels of access to ICT at home, home support for ICT use, and home support for literacy. These three key factors are the key issues for many who work with young people in socially disadvantaged areas - how to enhance ICT access, to enhance outcomes associated with ICT access (such as attainment in literacy), by providing appropriate support.

Youth workers come into contact with a wide range of young people. In youth and community centres it is found that the 11 to 16 year old age group are the largest users of ICT facilities, often because of limited home access. Facilities have been created in some poor socio-economic areas to attempt to address limited ICT access both at home and in the community. Young people at risk of offending were a group that had been a target for ICT development in one urban area, for example. In another area, young people were being supported in developing their own web-site. Educational welfare officers felt that there was a greater need for events and initiatives that were ICT focused to support young people in poor socio-economic situations.

Community centres were being developed in some areas to support groups of young people such as those from certain ethnic minorities who were non-attendees at school. In a number of areas, a different tailor made curriculum was being created for individual pupils who were at risk, disaffected or excluded. In one example, an FE college offered an ICT course, and in another, ICT provision was accessed through a community centre and ICT was offered as a subject course (CLAIT). Careers officers interviewed were aware of some initiatives that involved young people who did not have ICT facilities at home, or with low levels of literacy. One initiative involved work developed with the community and with parents, another was concerned with research and public speaking, and two others focused on the development of web-sites that offered young people a voice (through the production of a newsletter in one case). The police officers that were interviewed also often come into contact with groups of young people whose literacy levels are low. Examples of projects that support young people with low levels of literacy and in poor socio-economic areas exist, but it appears that not all police officers or other support workers are aware of the potential that ICT can offer in this respect, and may not have adequate resources to implement appropriate interventions.

Those disaffected with traditional forms of learning
Some primary school teachers in the study felt that disaffection with learning is often related to a lack of ability to write and to read. This was supported by reports from secondary school teachers, and from police officers. ICT is being seen at a primary school level as a means to support pupils in terms of both reading (because of the desire to access the internet), and to write (because word processing offers facilities to easily amend and change writing). The quantitative survey results point to the impact that ICT could be having upon motivation to learning across the Key Stage 2 to Key Stage 4 continuum. It is believed that uses of ICT could, therefore, at a primary school level, if used in effective ways, support higher levels of literacy of pupils, and in so doing potentially reduce disaffection, anti-social behaviour and even crime at later stages.

Certainly the evidence from interviews with pupils suggests that ICT supports motivation in a number of respects which relates strongly to this scenario. ICT uses help pupils to feel that their work is better, and therefore that they can succeed to a greater extent (71 out of 78

secondary school pupils reported this). Pupils feel that ICT is important to a future career or employment, so offering them further future possibilities (72 out of 78 reported this). Pupils feel they can concentrate or focus more in lessons, so they are more inclined to be successful (58 out of 78 reported this). Pupils also report that attendance has been positively affected by the use of ICT (18 out of 78 reported this), and behaviour out of school is positively affected (14 out of 78 reported this). Given these models of how disaffected young people can be positively supported, then it is feasible that appropriate uses of ICT could lead to an improvement in literacy, increased attendance, and a reduction in juvenile crime. This is an area worthy of further exploration, as this study has only offered limited insights into this area. However, if reports from pupils and others working with young people in this area were able to be translated into effective action, then it is possible that something in the order of a 10% increase in attendance could be achieved, which could reduce youth crime by 10% (police officers refer to reports that link crime and literacy rates, and young offenders tend to have low literacy levels, and are poorly motivated in educational terms). In 2002/3, the total funds for the Youth Offending Teams were £202million. A 10% reduction in this figure alone would save £20million annually.

Evidence from teachers and those working at a youth and community level all suggest that more positive impacts on pupils disaffected with traditional forms of learning could be achieved in the future (as shown by schools and others working with ICT at the forefront in these respects). Of 21 teachers in primary schools who answered a question about disaffected children, 17 teachers felt that pupils who were disaffected in some way (or who were at risk of being disaffected because they were of 'lowest ability') could be supported through the use of ICT. Teachers reported that because they often could not write they were not engaged, but ICT provided easier access, and allowed them to write (reported by 5 teachers), that pupils could correct without shame, or delete and start again (reported by 3 teachers). Teachers also reported that ICT helped children to read, as they wanted to access the internet (reported by 2 teachers), but pupils had to have basic keyboard skills before they could begin to gain benefit (reported by 1 teacher). Of 41 teachers in secondary schools, 33 teachers felt that pupils disaffected in some way could be supported through the use of ICT. A head of mathematics reported how a badly behaved pupil, intermediate in terms of attainment in mathematics, was withdrawn for a term, used the computer on her own, then returned to the classroom after the term of withdrawal. A teacher of science reported that middle to low ability boys were motivated to complete coursework which they would not do otherwise. A teacher of history reported that when the interactive whiteboard was used, pupils who were disaffected paid much more attention; they all looked at the interactive whiteboard whereas they would not look at books. A teacher of art and design reported that a GCSE pupil with learning difficulties and also disaffected, had been using ICT for her work a great deal, and that word processing and use of the computer for design had changed her attitude to learning.

ICT in PRUs
ICT is beginning to be used in PRUs also, to support engagement with learning. In the case of one PRU that caters for pupils who have emotional and behavioural difficulties, ICT is seen as being able to make a major contribution to learning. ICT is seen as a medium that is enjoyed by most pupils in the PRU, that can allow pupils to present work in a professional manner, can help those with dyspraxia, and can support independent learning. Pupils enjoyed the use of sound and animation associated with CD-ROMs, presentational software and interactive whiteboards. It was found that interactive whiteboards maintain the pace of a lesson, while presentational software enables pupils to be creative. Many pupils who attend the PRU do not have access to ICT at home, and the PRU offers lunch time access to pupils. ICT has been felt to have improved the quality of work that pupils have produced – through

use of a revision package, in terms of research, and in terms of the graphics used for presentation. Pupil confidence is felt to be enhanced because pupils can move ahead at their own pace, and those with writing difficulties are also supported. Commitment to the learning task is found to be enhanced, as pupils can help each other more, and time on task can be longer (4 hours for a disaffected pupil working on a music program, for example). Teachers found that pupils enjoyed using ICT because they could be surprised with what they could achieve, they could collaborate more in terms of learning, and it offered greater responsibility.

Teachers in PRUs find that ICT provides them with more resources to support learning, particularly internet based and CD-ROM based resources. These resources, coupled with interactive whiteboard use, enhance the range of teaching approaches that can be taken. ICT enables extension activities to be provided, as well as being able to capture creativity. Learning styles of pupils are felt to be supported, and teachers report that they have higher expectations of pupils as a result. It is felt that pupils behave differently when they are using ICT, as they feel as though they are being treated more like adults. The head teacher at one PRU has seen, "*pupils move from being shy and self-deprecating to the production of a presentation, their working with a business person, and presenting to an external audience*".

Reports from teachers in one PRU that ICT is supporting engagement were also supported by quantitative evidence that classroom assistants routinely gather. Ongoing records of behaviour are recorded after each lesson. Each pupil has a personal target, and five areas of expectation are scored: politeness, following instructions, completing work, caring for property, and progress towards the personal target. Scoring on each area of expectation is done using four levels: 0 - no evidence of progress; 1 - little progress; 2 - some progress but target not achieved; 3 - clear progress.

During one week, records of scores of all 10 pupils aged 14 to 16 years in the PRU were analysed by grouping the lessons into four categories:
- ICT lessons.
- Non-practical lessons with ICT.
- Practical lessons without ICT (art, crafts, cookery, games).
- Non-practical lessons without ICT (mathematics, English, science, history, geography, careers, PSE).

The average mean scores for the areas of expectation in these different lesson categories is shown in Table 9 following. The highest average mean score in each category has been highlighted.

Lesson Category	Politeness	Follows instructions	Completes work	Care for property	Focus on personal target	n
ICT lessons	2.69	2.08	2.92	2.92	2.31	14
Non-practical with ICT	2.23	2.34	2.48	2.57	2.34	35
Practical without ICT	2.23	2.26	2.41	2.26	2.41	39
Non-practical without ICT	2.12	2.10	2.26	2.19	2.00	132

Table 9: Average mean scores of five measures of pupil expectation reported across one week in different lessons groups for pupils in one PRU (n=220 lessons)

From Table 9 some indicative outcomes can be drawn. Caution should be taken as the figures are small in some cases. These results indicate that within ICT lessons, pupils score higher overall in terms of politeness, completing work, and caring for property. However, their focus on their personal targets may not be as high as it is in a practical subject, even where ICT is

not used, and they may not follow instructions as well as in subjects other than ICT but where ICT is being used. Results from larger studies of this nature would be helpful in confirming, or otherwise, the indications shown by these figures.

In some cases, where ICT is taught as a subject, varied or lower motivational impacts can arise. An ICT co-ordinator in a PRU uses ICT within an IT centre, a room with 8 high specification PCs, a colour printer, and an A3 printer. There are about 24 to 30 pupils in the centre, many being emotionally vulnerable. It was found that some pupils would use computers all the time if they were given the chance (but not others). It was found that motivational outcomes tended to be short term, and the attention span of pupils tended to be no more than 15 minutes. The pattern of uses of ICT, however, did not use the communication potential of ICT, and did not focus on reading or writing particularly. ICT was used for research quite a lot. Web-based research was used to find pictures, and pupils also used a graphics package. There was some use of email, but it was not standard. Internet access was used as a reward, and access was targeted for pupils with 'low ability' (for use of specific programs). At Key Stage 3 there were two IT lessons each week (run as an IT subject), with possibly another 2 IT lessons when ICT was used in other subjects. ICT was used in English for word processing, and in mathematics for games activities. Some revision material accessible via the internet had been used and enjoyed by year 11 pupils. CLAIT was taken as an examination qualification where possible, as pupils liked to get an IT certificate. It was found that year 10 and 11 pupils at the school had often not had access to ICT at their previous school, and not many pupils had ICT at home. There were restricted community facilities available. There was a drop-in café in the city, and youth centres with computers. Pupils could save work to folders, but there was no access outside the school to their work.

Some ways in which ICT is being used to support projects within PRUs is leading to stronger motivational outcomes being reported than when ICT is focused only in ICT lessons. ICT was involved in a multi-agency village project, for example. ICT was used as a means for pupils to create publicly accessible work, and pupils were given awards for their outcomes. As a result, vandalism was reduced in this village setting.

An example of a project involving ICT that was run in one PRU involved a freelance artist who worked in youth centres, youth contexts and PRUs. Her experience suggested that publicly available work, art work in this case, was likely to motivate. She focused on a number of specific projects, using laptops and video cameras that drew immediate attention from pupils. Interested young people worked for a whole day, producing a publicity picture. There was a visible result at the end, and their contribution was externally valued. Young people saw the professional use of a digital image manipulation package, and recognised how the work could be undertaken using the techniques offered by this package. The freelance artist worked informally with the young people, but defined their roles within groups or teams. She used video for evaluation purposes, and to record video diaries. The use of cameras, video, and immediacy of results was found to be motivating. The artist found that disaffected pupils could be creative, especially when digital imagery was used well. She set up projects that could not fail, since self-esteem was very important. She found that pupils could be put into a 'cannot draw' bin, and ICT was used to challenge this perception.

ICT was used as a tool to research, for image gathering and manipulation, to shape imagery and enable creativity. ICT was a leveller in these situations; it allowed visual imagery to be approached by all. The pupils who 'cannot draw' could be supported in this way. Self portraits were created in one project in which a major television company was involved. The involvement of a TV company was found to be a huge motivator, with work going into a

gallery, so pupils focused on it particularly well. The project had a huge impact on one boy, who met with a television company VIP, and was presented on local media and national TV. Pupils have begun through projects like this to use some ICT equipment for the first time. The impact of this can be strong; use of a camera by a pupil not trusted with one previously can be a motivator.

Gifted and talented pupils
Gifted and talented children can be motivated when using ICT, especially when they can see easily how ICT will support what they want to achieve. Some teachers in the study reported that gifted and talented pupils tended to pick up IT skills more quickly. It is clear from comments from both teachers and pupils, that the forms of ICT that tend to be used most by those who are gifted and talented are concerned with aspects of information, rather than communication. The access to resources from the internet, for example, is seen as a real benefit for pupils in this group, a benefit that can not only extend their learning, but which has motivational impact. Of 13 primary school teachers who talked about impacts on gifted and talented pupils, some indicated that ICT stretched pupils in this group (reported by 4 teachers), but that pupils in this group were less easily impressed by pictorial representation or sometimes not challenged by the software (reported by 4 teachers). However, teachers also reported that internet access allowed deeper levels of research (reported by 3 teachers), and that some gifted and talented pupils were very enthusiastic about ICT use (reported by 2 teachers).

Responses from 35 secondary school teachers who talked about impacts on gifted and talented pupils were generally positive but qualified. A head of ICT said that extension work could be set easily for this group, that there were no constraints on how deeply pupils could get into issues on the internet, and that they could extract and analyse information on their own. A head of technology said that it allowed pupils to become much more autonomous learners, that there were no limits to what they could achieve even if it was beyond the teaching staff, so they could forge ahead on their own. A head of modern foreign languages reported similarly that ICT use encouraged more independence, enabled pupils to go deeper into languages, and also helped pupils to develop thinking processes.

The quantitative analysis had a limited amount of data available on the performance levels of pupils within the sample schools, but supported teacher views. There was a tendency for higher attaining pupils to find work with ICT more interesting. By contrast lower attaining pupils reported more instances of ICT supporting their learning and liking ICT as it helped them to work better with others.

Impact of ICT beyond the school

Key findings
- Motivational aspects of ICT are being used to support learning through out-of-hours initiatives in a range of contexts. Computer clubs are the most common form of out-of-hours initiative in this school sample, but most out-of-hours initiatives that involve ICT are found to be popular with pupils and young people.
- Out-of-hours access has been an important support for some young people who are disaffected or at risk. Pupils have gained qualifications from access to out of school facilities in some instances.
- Many pupils feel that ICT is an important area of learning for their future. This perception is supported by teachers, parents and those working in youth and community areas. However, there is evidence that pupils may have misconceptions about the ease of gaining ICT based employment.
- There is evidence from the study that skills developed in out-of-school situations have a positive bearing upon motivation and confidence within in-school settings.
- ICT has been used in some cases to support strong partnerships between schools and external agencies or groups. However, there is more potential for this area of development.
- ICT has been used in only limited ways so far to enable those working in youth and community settings to support and be involved with education through the ICT medium. Those working in this field are sometimes unaware of the potential that ICT can offer, or not able to access funding or resources to develop partnerships further.

School initiatives to extend out-of-hours work with pupils
A wide range of out-of-hours initiatives have involved ICT in the situations studied, and in many cases the motivational potential of the ICT has been the reason for integrating it. Out-of-hours access provided by primary schools tends to be in the form of breakfast clubs and summer schools. Secondary schools are more involved in offering before school, lunchtime and after school access to library resource areas or ICT suites, while some offer ICT clubs or homework clubs. Special schools and PRUs do not tend to offer out-of-hours activities, especially as after school access to ICT can present problems when pupils have to catch buses (as is the case with rural schools also). Involvement of ICT in family learning has been a successful focus at a parent level for one school in the study.

Teachers in the study reported that many out-of-hours initiatives have had positive motivational impacts upon pupils. Primary school teachers reported impacts arising from involvement with computer clubs (by 9 teachers), a computer club in a local secondary school (by 2 teachers), a laptop project where laptops were taken home (by 2 teachers), weekly sessions run for parents (by 1 teacher), and after school clubs (by 1 teacher). Secondary school teachers reported impacts arising from break time and lunch time use (by 5 teachers), a computer club open to all year groups (by 3 teachers), after school use (by 3 teachers), and individual teachers reported impacts from community classes within the school, access in holiday periods, lunch time use, Saturday clubs, coursework access for year 11 pupils on 2 nights a week from 5 to 8 pm, a learning resource centre open to 5 pm every day, and revision classes at lunch times. Secondary school teachers reported motivation arising from work at home with family members (by 4 schools), links with schools in other countries (by 2 schools), and individual teachers reported motivation arising from entering challenge competitions, gap year pupils being able to stay on at school and work with the ICT and manufacturing industries, and a summer school.

Out-of-school uses and access

Out-of-school access to ICT provided by centres other than schools is available in some areas. The use of ICT in youth and community centres is, in some instances, an important factor in contributing to activities in which young people can take part. Youth workers reported that young people liked to have access to the internet, especially those without access at home. Access to email and IT training or those who could offer IT support within rural settings was highlighted as being particularly important. However, few youth centres offered courses. One town had a drop-in centre for internet access in the youth centre, but it was only open one evening each week, and able to be booked for a 15 minute session only. In another area, village mini internet cafes had been established.

Educational welfare officers in some areas have supported 'education otherwise' alternatives (education provision outside mainstream school settings) by providing young people with software packages that they could take home. Specific programs on mathematics, English, science, GCSE and SATs revision, have all been welcomed and used by pupils. In one area non-attendees in school focused on an ICT project, which boosted their confidence, and their self esteem. Internet and specific graphics packages were often used to support these activities. One example was given of a girl who, using ICT packages to develop a background understanding of a range of subject areas including ICT, went on to take a college course. In another example, a local community centre was used for ICT access, used by 2 girls taking a CLAIT course. ICT was found generally by educational welfare officers to be popular with young people who were non-attendees at school.

Careers officers have found that ICT in out-of-school settings could support pupils in a range of ways. ICT has been used to provide pupils with information prior to job interviews. In some cases it was found that internet access led to discussions of ideas with parents. On some occasions this helped pupils to gain more realistic ideas. Specific careers packages were used often to support pupils, and this extended ideas of possible courses for some pupils.

Youth and community based workers varied in their awareness of out-of-hours facilities, and how ICT could be used in these instances. Police officers were aware of out-of-hours access to library facilities (often up to about 8pm), but other events, initiatives, or projects involving ICT were limited in number and scope. Library access to ICT was often unsupported, as was access in internet cafes, for example, and this provided use only for those who knew how to use the facilities.

FE colleges run evening courses in some areas, but travel can restrict access to young people in rural areas. Funding for developing access to rural areas, through initiatives involving the creation of an ICT bus, for example, is often limited. The two health workers who were interviewed said that they wanted to develop out-of-hours access and use, especially for young people who want to contact someone with regard to a health or health-related issue anonymously. However, the health workers said that the ICT facilities that they have is often at a low level, and there is little support for this form of activity.

Some summer scheme projects have aimed in some areas at addressing the needs of young people, particularly involving use of facilities such as digital cameras. For specific access to careers information, careers offices may be open for young people to access the internet up to about 5.15pm on weekdays or 1pm on Saturdays. Youth workers have supported out-of-hours access through youth centres, but often this access has been limited. In one youth centre, evening access was restricted to two hours for one evening per week, and in another, to two evenings, but use was related to work going on in the centre at that time. Some youth centres

have drop-in internet cafes, and some towns have internet cafes, but not specifically targeted for young people. Some community centres have internet access, but others have no ICT facilities at all. Some community centres, such as a Bangladeshi After School community centre with 2 ICT suites in one town, does cater for young people specifically. Homework use is encouraged, as well as parental support and involvement with young people. School holiday uses are encouraged also, and design packages are used in projects to encourage young people to produce cartoons, animations, and presentations. Generally, it was found that young people needed support when using out of school facilities.

In terms of out-of-school uses of ICT, it is clear that these are increasing, but whether school and other agencies are accounting fully for this shift is not yet clear. When asked about uses of ICT outside school, many pupils reported using ICT facilities, but most indicated that these were within their own homes. Of the 78 secondary school pupils interviewed, many indicated that they used ICT outside school for homework, especially for writing and for internet access. Some pupils indicated that they used school library facilities (4 in number) and one pupil indicated using access in an internet café. They indicated that ICT facilities outside school were used for writing (in 12 cases), researching (in 11 cases), playing games (in 7 cases), presentation (in 5 cases), finding pictures or printing images (in 3 cases), communicating with friends or other people (in 3 cases), watching DVDs or CDs (in 3 cases), browsing the internet (in 2 cases), designing and drawing (in 2 cases), and revising (in 2 cases). The same forms of use were reported by primary school pupils, but in a different order, playing games coming first (8 pupils), then looking at pop stars or other things on the internet (6 pupils), writing stories (2 pupils), using email (2 pupils), accessing an encyclopaedia (1 pupil), and creating a family tree (1 pupil).

The relationship between out-of-school and in-school use of ICT is being considered by some schools strongly. Head teachers reported that home environments and parental attitudes do have an impact on the motivation of pupils, that shared learning and family learning developments are important aspects to consider, and that parents and those outside school may need to be supported both in terms of how to support learning, and in terms of access to technology. They indicated that pupils who use ICT outside school have more practised ICT skills, stronger attitudes towards ICT, more abilities in terms of independence of learning, and that some pupils prefer to access the internet outside school, and increasingly to work in on-line ways increasingly. A few classroom assistants reported that some types of ICT use were more accessible to pupils outside school than inside school, such as mobile telephone use, for example. Many classroom assistants also reported that home use positively affected school use of ICT. Of 17 parents who commented, 15 thought that early access to ICT was important for children, because this affected their abilities later. Most secondary school pupils who were asked about this issue (43 out of 48) felt that confidence gained or skills used outside school were helping them with their schoolwork.

An indicator from the quantitative results that is of importance here is that the measure of academic efficacy is high in both primary and secondary sectors. A high proportion (around 84%) of pupils rate themselves positively on the efficacy measure in relation to ICT use. This suggests that pupils know what to expect to achieve when engaged with ICT and that they personally believe that they can do it. In many respects, this is a testimony to the ability of ICT to help both teachers and pupils obtain clarity in goals and steps needed to achieve them.

Impact of ICT on careers
The perceptions from teachers, pupils, parents, and youth and community workers is that ICT will have an impact upon careers in the future. But there is currently a much lower level of

understanding of how ICT out-of-school educational activities can relate to and impact on careers.

In terms of future careers, most secondary school pupils who were interviewed (72 out of 78) felt that ICT would be important in the future, many pupils felt that all jobs would be affected, and that work on computers would increase rather than stay the same. Primary school pupils reported similarly. Some pupils indicated that their parents were using ICT and email a great deal, and that they saw this as a model of their future needs and practice. Career officers indicated that there was a misconception currently about the ease of getting jobs in the IT sector, and that this sector was not as strong as it was. However, they also reported that ICT skills were important for careers generally, and that pupils needed to be well qualified in IT terms. They have found that FE colleges often provide effective IT courses, and that vocational courses are supporting pupils more in terms of gaining IT qualifications for furthering careers. They find that some training providers are providing CLAIT and ECDL courses free, and that more boys than girls still go into ICT careers. Parents who commented on the importance of ICT for the future (17 in total), indicated that they felt that ICT would play a part in any career in the future, or might be their child's career of choice.

Partnerships involving ICT beyond the classroom
For some schools in the study, the development of partnerships has been fundamental to their successes with ICT implementation, and to their successes with initiatives involving ICT. In PRUs particularly, partnerships are important in terms of gaining access to project approaches and ideas that can involve young people in activities that have a motivational impact. Head teachers reported a range of partnerships with others where ICT was involved, including a university to enable teachers to work as researchers, the British Council, Family Learning centres, companies and businesses, and UK Online Centres.

The primary schools in the study had not at this stage developed many partnerships involving ICT beyond the classroom. One example involved links with a number of computer companies. Examples offered by secondary school teachers were in seven different categories: links with feeder primary schools (for example, primary school pupils attended the secondary school once a week and sixth form pupils taught them basic ICT skills, such as the use of presentational software and web-site searches); links with partner schools (a link with a local school for pupils with severe learning disabilities who have an ICT lesson once a week); liaison of the SENCO with other agencies using email contact, with educational psychologists, counsellors, Connexions, etc.; links with companies, particularly those using manufacturing and design software; an exchange every other year with a school in Germany (in 2003 email was used to put pupils in touch with their exchangees before the exchange); and parents being more involved (many have email and correspond directly). This is an aspect where there is clearly more potential for future activity.

Educational welfare officers have been involved often with the use of ICT in creating or developing partnerships. These partnerships involve the police, youth inclusion programme officers, social welfare officers, and teachers. Educational welfare action plans may be circulated via ICT, and amended through an ICT medium, to the school, educational welfare officer, child psychiatrist, parents, social services, and educational psychologist, for example. Police officers are largely aware of, or are involved in, the use of ICT in creating or developing partnerships. Email links to local councils, crime reporting via email, and school email hotlines have been developed. Email is considered to offer an effective and rapid way to communicate issues to schools, such as alerting them to the fact that someone is offering lifts to school children. In one area, a web-site had been created to enable crimes to be reported.

Careers officers are largely aware of, or are involved in, the use of ICT in creating or developing partnerships. They recognise the value resulting from parental involvement that can be achieved through uses of ICT, but that confidentiality issues do need to be adequately considered and addressed. Some careers officers have been involved in developing partnerships through initial email contact, and then video conferencing contact. Having a platform to communicate with occupational therapists, youth offending teams, doctors, and disability support workers, for example, has been important. By contrast, youth workers are largely not aware of, or are not involved in, the use of ICT in creating or developing partnerships. In one area, a youth web-site is being developed across a county. Health workers are largely not aware of, or are not involved in, the use of ICT in creating or developing partnerships, although they see the potential that a development of this form offers. Development of partnerships using ICT has therefore begun in some areas, but not in others.

Good practice examples of using ICT and digital content to improve pupil motivation

Key findings
- All teachers interviewed in this study have indicated that ICT can be used effectively within their subject areas. Pupils are quick to notice disparity across subject areas, and their motivation is less when levels of valuable use are restricted.
- Teachers are finding that ICT can be used effectively to plan lessons, to create resources that focus on learning and from a learner perspective, to deliver lesson components, and to enhance subject or curriculum needs.
- Good practice where pupil motivation is high is concerned with the ways in which a range of ICT resources are used, and how uses within the subject or curriculum area link into wider school approaches on learning, assessment and reward systems.

From across the study, there were no comments from teachers or head teachers that the curriculum did not fit with ICT use, or that ICT use could not be applied to the curriculum. It is clear that pupils and teachers who were involved in this study felt largely that access to ICT and access to resources had reached a level where ICT could be applied to the curriculum, and curriculum purpose could be supported by ICT. However, schools felt that ICT access was sometimes still an issue, and that enhanced access would enhance use in a range of subject areas, enhance motivation and, potentially, outcomes. In secondary schools involved in this study, certain subject areas still felt that their access to ICT was limited, and that they could positively exploit a wider access to ICT facilities.

The most effective fit of subject curriculum to ICT use, where positive pupil motivation has been reported, and where some enhanced attainment is being linked by some teachers, is in the area of design and technology. The design and technology curriculum is typically module-based in years 7 to 9, and option based in years 10 and 11. Table 10 following describes the ways in which ICT was used in the design and technology curriculum in one school. Practice in years 7 and 10 is described, but similar practice existed in other years.

Some of the consequences and implications for learning arising from this form of embedded approach are that:
o   modelling becomes a less difficult process, and it is easier and quicker for teachers to relate models to real objects.
o   design can rely upon thinking in 3D, rather than trying to relate 2D images to 3D objects.
o   drawing can be done by many pupils who could not previously manipulate ideas and pencil drawing techniques.
o   the focus for the design and technology process has shifted from task to process much more.
o   changes and amendments, clarity and detail, are easily accommodated through use of appropriate software.
o   research facilities enable pupils to select individual topics of interest much more.
o   communication facilities enable wider perspectives to be gained, and more rapid responses to queries to be made.
o   presentation is an integral part of the process of design, often concerned with sharing and summarising.
o   the design and technology processes mirror those in industrial situations far more, particularly as few drawing offices now rely upon paper and pencil techniques.

Year	Uses of ICT
7	There are 3 projects across the year, each of 12 week duration.
	Email is used by all pupils, and a tutoring system is used within the classroom.
	Pupils complete projects within a book, by hand, and the learning is structured into 'steps'.
	Project 1 – to create a design. Pupils need to use desk top publishing software, cutting pictures, creating pictures, undertaking research and searches with a search engine, pasting images onto a word processing page, changing sizes, fonts, and printing out.
	Project 2 – to design a Key Fob, initially with pen and paper, then putting the design into a 3D design package, drawing to co-ordinates, and using CNC machines to make the end product.
	Project 3 – involves practical skills, and ICT is not used particularly.
10	All pupils take a technology subject at GCSE, and options include resistant materials.
	In the resistant materials option, the year is divided into five component elements.
	Component 1 – focuses upon tasks on resistant materials in the workshop, but 1 lesson out of 2 is run in the computer suite, with research done on woods. Each group produces a presentation using ICT.
	Component 2 – a minor project is undertaken, and page layout is created in a presentational software package. The situational brief and time plans use word processing and presentational software packages. Email is used for homework, and links to web sites are provided. 90% of the research is done on the internet or on CD-ROMs. Relevant summaries are produced in ICT packages.
	Component 3 – designing starts with pen and paper, but is quickly moved to use of a 3D design and modelling package. The final design is produced in the workshop by hand, or using CAD/CAM machinery.
	Component 4 – the product is completed and tested with a client. The evaluation produced is done in word processing and spreadsheet packages, to be able to create charts and graphs. Statements of conclusions are written using ICT.
	Component 5 – a major project starts. Brainstorming initially involves the whole class, using a tablet PC, then individuals begin their own brainstorming. Existing products are researched on the internet largely, and emails are sent to companies.

Table 10: Details of the design and technology curriculum in years 7 and 10 in one secondary school

The study identified a range of other examples of good practice in other situations. An example of how ICT was integrated in similar ways to that in the design and technology curriculum, but to support pupils disaffected with traditional forms of learning came from work in a PRU with a freelance artist. In one project the ICT used was a digital manipulation package, video, and digital cameras. Pupils had options accessible such as video that were not normally available. The projects integrated external contacts and thinking, links with the outside world, such as opportunities for young people at risk to work with a television group. The freelance artist found that motivation in PRUs was a key factor, and that group behaviour needed to be tackled through suitable projects. She ran one in-school project using ICT, to produce a collage of pupils' names. The collage was not vandalised or touched - ownership had been raised. Similarly a project on redeveloping a courtyard, a community project making murals, for example, was undertaken with excluded pupils. Purpose and audience were important - the project created a real outcome in an external environment.

Other subject and curriculum areas have begun to explore similar forms of approach that have been exemplified by design and technology teachers. Use of internet based resources and interactive whiteboards were examples of facilities that were being explored in various ways. An important element in this development was the additional availability of resources that ICT could bring. Teachers in the study reported widely that ICT was offering them enhanced resources to support learning. The need to invest more time and work initially was highlighted, but teachers also reported that after some time the sharing of planning and of resources meant that time was saved. Primary school teachers reported that ICT had provided more resources to support learning for preparation of and access to worksheets (reported by 4 teachers), and in terms of use of presentational software (to support the visually impaired) (reported by 3 teachers), for example. Secondary school teachers reported that access to internet resources had had a huge effect (reported by 15 teachers), in terms of use in lessons (reported by 3 teachers), that once materials had been created they could be adapted and

stored, so saving preparation time (reported by 3 teachers), and that interactive whiteboards enabled resources to be accessed at the touch of a button (reported by 3 teachers). One teacher offered an example of the impact that ICT had had, *"being able to use things like the web-cam to show the effects of different temperatures in various countries has made pupils enthusiastic about an aspect of geography which previously could only be described in words. It's added a new dimension. My enthusiasm is passed on to pupils"*. All classroom assistants reported that ICT had provided more resources to support learning, and a few classroom assistants had specific roles in finding or creating ICT based resources for pupil or teacher use.

Good practice has involved the widening of teaching approaches that have been used in classrooms. All except one secondary school teacher interviewed thought that ICT positively enhanced the range of teaching approaches that could be used. Levels of interaction, the visual quality of resources, the immediacy, the ability to refresh work and to do it again, were all indicated as ways in which ICT could enhance the range of teaching approaches taken. Teachers with interactive whiteboards said that they used features that meant that pupils could observe, then talk and then question to increasing extents. All except one primary school teacher thought that ICT positively enhanced the range of teaching approaches that could be used (and this teacher thought use of an interactive whiteboard would enhance approaches).

Motivation has been enhanced in many cases by the ability of teachers to differentiate more. Although teachers reported that ICT could enable differentiation by ability more, it often meant that teachers needed to create their own materials. In some software, there were different levels of use that were possible. In some schools staff shared materials, so if a teacher produced something that worked well with certain groups of pupils, others could make use of these resources. Most classroom assistants reported that ICT was supporting differentiation positively, and that individual pupils' needs could be supported more. Primary school teachers said that they could produce differentiated worksheets, using cutting and pasting, they could find internet resources aimed at different ability levels, that pupils could research to their own level, but that they needed to find levels of text that were appropriate. Of the 35 secondary school teachers interviewed, 26 teachers reported that ICT did enable them to differentiate by ability more. They reported also that it enabled the teacher to identify more easily those who were having difficulties, it was possible to differentiate by task more than by outcome, it allowed pupils to show others how to do things, and that the teacher's hand writing did not need to be interpreted by those finding reading difficult. One teacher gave an example of how she had approached differentiation, producing differentiated web sites, one easy, the other more complex. The level of each web site was made explicit to different groups of pupils, who could choose depending on how good their ICT skills were.

Pupils and teachers reported widely that ICT was used effectively when it enabled particular learning approaches to be matched. Teachers and support staff reported that pupils were motivated often because they were being supported in terms of visual, auditory and kinaesthetic approaches to learning to greater extents by ICT. Effective practice often relied upon the abilities of teachers to match the facilities that ICT offered to these aspects of learning. Primary school teachers indicated that they identified ways to use ICT that would offer practical approaches, how to try things out more, how to use visual approaches, feedback and auditory approaches, and how different paces of learning could be accommodated. Secondary school teachers gave similar ideas of the ways in which they used ICT. Additionally they indicated that they looked for how kinaesthetic learners could be supported more, a flexibility of approach through wider ranges of resources, such as interactive whiteboards and data loggers, how sound could have more impact, use for independent learners, how pace could be changed for different groups, using email to send

lessons notes to pupils who missed lessons, monitoring what pupils were doing, and how discussion could be encouraged more.

The use of ICT to support learning through pupil tracking was important in schools. One teacher indicated that, "*my job as head of year without IT would be a nightmare*". The teacher retained spreadsheets of pupil achievements in all subjects. She created certificates of attendance, and believed that these had a knock-on effect on learning, as she could keep a closer eye on her year group and sort out any problems quickly.

Good practice also related in the schools studied to school wide approaches and effective leadership and management. Head teachers indicated that school wide approaches were important in terms of overall motivational impact. They indicated that planning should be supported through a site-wide communications system, classroom use might be supported through laptop sets on trolleys, interactive whiteboards linked to laptops could affect teaching and planning, and access to ICT through IT rooms, library or resource centres, and staff room access had been an important factor. They indicated that staff laptops supported the ways in which data could be used to monitor achievement and progress, that the quality of resources put before pupils should be increasingly higher, and that access to resources from the internet should be aided and used increasingly. A case study example of the school wide approaches taken by one secondary school, and the positive motivational profiles that were identified by the study, is offered below.

School setting
The school is in a disadvantaged area, and unemployment is high. Many pupils do have access to some ICT at home. Almost all pupils are white, but there are a small number of traveller children.

ICT facilities and deployment
The library is well equipped with computers, there are two main ICT rooms, half sets of computers in other departments, and use of interactive whiteboards in many classrooms.

School-wide approach
The head teacher and senior management have taken a school wide approach to ICT. Support from senior managers is strong, but teachers are provided with the facilities to enable them to work within their classrooms and work areas. ICT fits into the ethos of the school as a whole, including the rewards system.

Uses of ICT for teaching
There is a strong emphasis on use of interactive whiteboard technology in departments. These facilities, coupled with laptop access, provide teachers with the facility to use ICT for teaching. Many teachers have produced resources for use on interactive whiteboards.

Uses of ICT for learning
Pupils have access to ICT in a central area, and on clusters of machines in some departments. Pupils are encouraged to use ICT to produce work, and to use their home access as well.

Uses of ICT to monitor pupil progress and set targets
ICT is used to provide a strong monitoring and target setting facility. Teachers and pupils are involved in this process, and ICT is used as a way of maintaining records, and offering pupils a 'neutral' view of assessment outcomes and their progress towards targets.

Approaches to staff and professional development
Staff are supported in their professional development with ICT. In-school courses focus on learning as well as on ICT.

Links to parents, out-of-school activities and home ICT
External links have not been developed widely at this stage. Access is provided to resources outside school hours, but travel is an issue for many pupils.

*Out-of-school and homework uses of ICT*
Homework and out-of-school uses of ICT are encouraged. Pupils are encouraged to start and complete work using ICT, for writing, research, or design purposes, for example.

Levels of expectations of teachers when using ICT
Expectations of pupils when they use ICT are higher in some subject areas. This is true of design and technology particularly, but use of ICT occurs widely in other subject areas.

Motivational measures of pupils
The motivational profiles for the secondary schools assessed through motivational cluster analysis are shown in Figure 10 below (the case study school is school number 5).
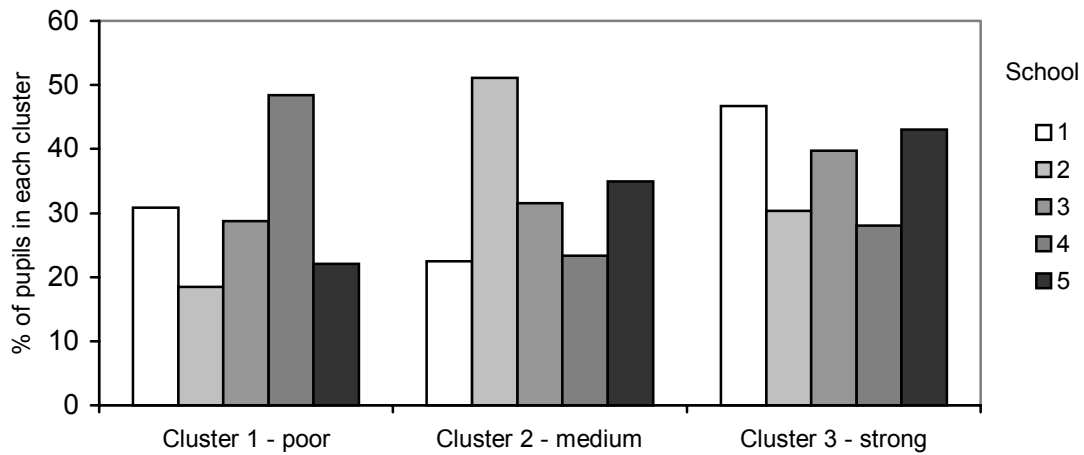
Figure 10: Pupil representation across motivational clusters for the case study secondary school

As can be seen, relative to the other mixed gender schools for whom comparable data was available, the school in question has a relatively low proportion of its pupils in the poor cluster and a high proportion in the most positive cluster. The overall motivational profile for the school is shown in Figure 11 below.
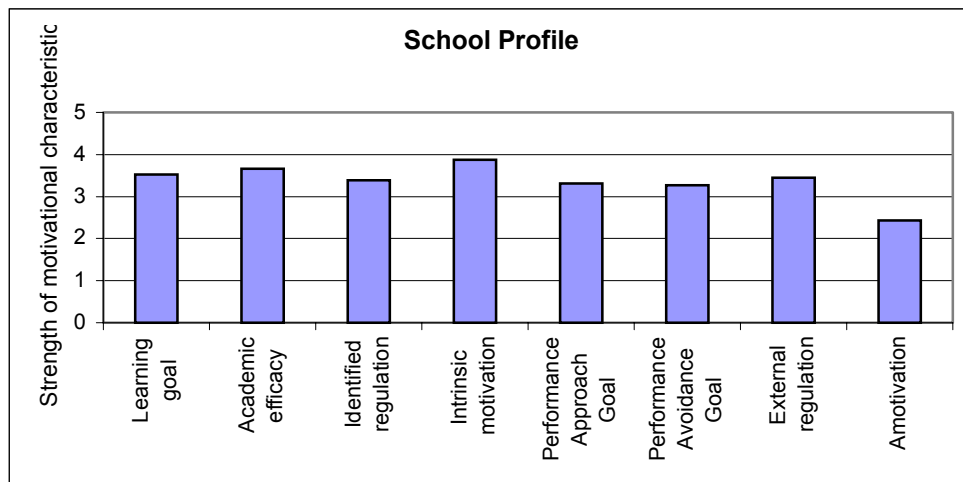
Figure 11: Motivational profile of case study secondary school

Intrinsic motivation for ICT and academic efficacy are both high while amotivation is relatively low. Learning goals are higher than performance goals. Overall this school is succeeding in developing a strong sense of academic confidence and a clear focus on learning when its pupils are engaged in ICT supported work. This is reflected in the higher score for perceived learning structure than for a performance structure in classes when learning is being supported by ICT. On the attitudinal measures, pupils at this school reflect the generally very positive pattern of attitudes towards ICT supported work in the whole sample. They show particularly high responses to finding schoolwork more interesting with ICT, an increased capacity to pay attention with ICT, gaining better understanding through the use of the visual modality and working with other people. There is a strong recognition of the importance of ICT in their future.

The findings from this research have shown that motivation has been enhanced most positively in school situations where ICT is used within a framework that considers impacts upon learning, teaching, and the management of learning and teaching. This view is broadly supported by the pupil questionnaire data. Pupils have positive attitudes to the use of ICT and report that ICT does indeed seem to help them to engage with learning through supporting work with differing modalities and in working with other pupils. There is an overall association between the more positive forms of motivation (learning goals and identified regulation, for example) and attitudes to the use of ICT. ICT then, is seen by pupils as a learning aid rather than a means to gain a competitive advantage over other pupils in the class, or a means to avoid having to engage in the learning process.

Conclusions

Overall, within the school situations studied, the evidence gathered supports the notion that positive motivation is arising from uses of ICT, and that it is having a positive effect upon pupils, teachers and learning. The head teachers in the study (in primary, secondary, special schools and PRUs) highlighted some important factors in this respect:

o   ICT can motivate pupils and staff within a school.
o   ICT use needs to have an appropriate pedagogy linked and used with it.
o   ICT is seen to improve motivation, makes classroom management easier, makes subject topics visually attractive, but long term impacts on attainment are not always apparent.
o   ICT enables a multi-sensory approach to both teaching and learning, and many children need visual, auditory and kinaesthetic stimulation in order to enable learning.
o   ICT supports independence of pupil working and pupils feel more in control of their learning when it is used appropriately.
o   ICT can be used to extend the teaching day (by enabling pupils to work on tasks outside classrooms and in ways that they could not do without using ICT), and supporting communications between teachers and pupils is motivating for both teachers and pupils.

Some schools are looking at ways to deploy and use ICT in order to support both teaching and learning. Where a focus on both of these aspects is being made, the potential for impacts upon motivation appears to be greater than if there is a focus only upon teaching (as there might be in a school where ICT courses are run without any integration of ICT in other aspects of teaching or learning, for example). Where school approaches have considered both learning and teaching, head teachers were able to describe impacts at a whole school level, as well as at different group levels. It was clear that ICT impacted in these schools not upon specific elements (such as specific topics within a curriculum, or particular subjects), but upon a wide range of elements (subjects, curriculum topics, learning approaches, teaching approaches, for example) and groups (subject teachers, classroom assistants, school managers, gifted and talented pupils, pupils with special educational needs, pupils disaffected with traditional learning approaches, pupils with particular behavioural patterns, and pupils at risk), and that this collective pervasiveness was an important factor in terms of the entire motivational impact and outcomes.

Head teachers described motivational impacts of ICT in schools at five levels:

o   the school as a whole. Communication aspects were reported to be particularly important, with both teachers and pupils being able to communicate more between school and home, and this facility was felt to enhance motivation. Enhanced independence of working was considered to be motivating, but so too were the improved abilities to share and review. The cross curricular nature of the use of ICT was felt to be important, as well as the capacity for teachers to observe pupils and learning more readily. Impacts upon the ease of planning were felt to be motivating, and the ways in which ICT enabled more of an integration of the school within a wider community setting. The impact that ICT had upon calmness and a working ethos was felt to be motivating.

o   the senior management team. Communication aspects were also felt to be motivating for this group, with ICT use enabling discussion prior to meetings, as well as afterwards, to far greater extents. Use of ICT for presentational purposes was felt to enhance professionalism, and ICT was felt to have motivational impacts when it was used for planning. The use of ICT for analysis of curriculum data, for setting targets, and for monitoring outcomes was felt to motivate positively those who were involved in these uses, partly because of the ease of access to such data. The use of ICT for reporting purposes was felt to offer an ease of use that was motivating.

o the teachers. The enhanced reflectiveness of teachers when using ICT was felt to be motivating, as was the use of ICT in terms of planning, and the fact that teachers could be more demanding of pupils. The enhanced quality of work being achieved was felt to be motivating, and the ways that ICT enabled teachers to focus upon production of lessons that were pupil and learning focused rather than teacher and teaching focused was also felt to be an important factor leading to greater effectiveness. The impact ICT was having upon the pace of lessons was felt to motivate pupils and teachers, as was the ability for teachers to share and review to far greater extents.

o the support staff. A growing focus upon the professional development of support staff with regard to ICT was reported. As a consequence of ICT use, an increasing focus was being placed on classroom assistants to support pupils directly, rather than their supporting teachers directly, and this was felt to have a positive motivational impact on support staff.

o the pupils. The features described in the four levels above were all felt by head teachers to contribute to positive pupil motivation. Pupil motivation was being seen not just as something arising from the individual pupil's attitude, but as something being supported by school ethos, by senior management team approaches, by teacher interactions, and increasingly by support staff involvement, with ICT playing a role in each case.

The confidence of teachers to use ICT was potentially an important pre-requisite to initial exploration of use, exploration of outcomes of use, and then leading towards recognitions of higher expectations that could result from uses of ICT by pupils. Head teachers indicated that staff confidence in knowing that technology would not fail was an important first step, that confidence needed to be linked to creative thinking about teaching and learning uses to allow teachers to use ICT as a teaching tool. Head teachers felt staff needed confidence to use ICT to allow risks to be taken, that could then move to leading edge use, and that peer observation and reflection were important elements within the entire process of the development of confidence. They highlighted the need for key people in senior management teams to work with teachers and support staff, to allow all staff to try uses of ICT in classrooms within a context of motivation, aspiration and confidence building.

Teachers indicated in this study that ICT was supporting learning through its motivational effects and also supported their ability to affect learning through teaching. They often referred to the opportunities and experiences that ICT could bring, which would otherwise not be available or accessible. Given these experiences, teachers believed that pupil ability was being affected by the use of ICT. Teachers indicated that pupils were more able to reach their highest potential level because they were less limited in terms of experiences that they could gain. As one teacher said: "*In this school it is all about experience; children need to explore things outside the area; a family's ability to offer experiences is important, it favours those who can manage it; ICT can offer experiences not normally encountered so there is a change of influence on experiences*".

General recommendations for practice
The way in which motivation is conceived by anyone concerned directly with supporting learning can have an impact upon how learning activities are created, how management of learning is planned, and the outcomes of learning. Eight motivational measures have been used in this study. Of these, the motivational measures to try and enhance in terms of improving motivation through learning activities generally are learning goals, academic efficacy, intrinsic motivation, and identified regulation. Examples of classroom practices using ICT that do this are offered in Table 11 following.

Motivational measure	Implications for classroom practice	Examples of practice using ICT that enhance these measures
learning goals	an interest in learning and how to use techniques to learn should be enhanced by ensuring that process is considered as well as outcome	email is used to send a homework on presenting a summary of a poem to the teacher, the comments are used by the pupil to amend the work and to add to it, so that the successive drafts incorporate elements of an explicit ongoing process of subsequent learning
academic efficacy	knowing the techniques that can be used to learn should be enhanced	strategies used by individual pupils to tackle mathematical problems that are presented as starter exercises on the interactive whiteboard are picked up by the teacher and discussed with the class
intrinsic motivation	pupils should gain ownership of the learning activities they tackle	research using internet based or on-line resources is tailored to the individual by giving choice of topic to match pupil interests when possible
identified regulation	pupils should understand increasingly the reasons for engaging in learning activities	a graphics package is used to enable work to be created in the style of a specific artist, the teacher explores the reasons why this is useful, and how the work can be displayed on-line for others to view

Table 11: 'Ideal positive' motivational measures, their implications, and examples of classroom practice

The motivational measures to try and limit in terms of learning activities generally are performance approach goals, performance avoidance goals, external regulation, and amotivation. Examples of classroom practice using ICT that do this are given in Table 12 following.

Motivational measure	Implications for classroom practice	Practice using ICT that limits this measure
performance approach goals	pupils should be encouraged to work together, to share and to compete against class targets as well as their own individual targets	mathematical starter activities are presented in quick succession on an interactive whiteboard, and pupils need to compete against the previous 'class' best mark
performance avoidance goals	pupils should be shown techniques that ICT can offer to enable work to be tackled	a pupil with writing difficulties is shown how a writing package enables writing to be changed easily, highlights words that can be checked, and how sentences and paragraphs can be moved around to shape a story for another reader
external regulation	pupils are encouraged to take enhanced ownership for learning activities	digital cameras are used to enable pupils to capture images during a visit, so that they can use these to recall events, and to write a story that relates to the things that they have chosen to capture as images
amotivation	pupils should become increasingly aware of why they are engaging in learning activities	the teacher wants pupils to create a scientific report on alternative energy sources, but discusses first the medium that pupils could use, in order to focus on the purpose of the report, how it will be used and by whom

Table 12: 'Ideal poor' motivational measures, their implications, and examples of classroom practice

Schools in this study where ideal positive motivational profiles have been identified have taken a range of whole school approaches to the development of ICT use. Motivational profiles, coupled with an understanding of certain approaches in a school, can give indications of school effectiveness and outcome.

Using the evidence gathered from this study, there are a number of key features that a school should consider if the motivational profiles of pupils are to be enhanced. ICT can impact on the quality of pupils' work, and on internal cognitive processes (such as reasoning and analysing) as well as upon internalisation (engaging pupils) and externalisation processes (reporting through writing and speaking, for example).

To maximise motivational impact from ICT, the outcomes from this study suggest that schools should:

- focus more on ICT uses to support internal cognitive processes (analysis, reasoning, evaluation, for example).
- ensure that there are appropriate higher expectations by pupils and teachers.
- focus uses of ICT on subject learning, rather than using ICT just to manage engagement or reporting, if attainment outcomes are to be fully realised.
- use ICT fully in the target setting, monitoring, and reward systems within the school as a whole.
- encourage pupils to use ICT effectively to become more independent in their learning, feel more in control, and gain ownership for their learning. Approaches to classroom management and ethos also need to support this shift.
- let pupils know what is expected of them when ICT is being used. The structure and purpose of lessons and educational activities then becomes all the more important.

In considering the list of approaches above, schools should also recognise that good practice in using ICT is likely to require a range of technologies to support a range of learning needs, appropriate to each subject. This range should consider the use of on-line resources, interactive whiteboards, word processing, digital cameras, digital content, presentational, and subject specific software. The integration of these different technologies at a class level is an important consideration. When this range of ICT is used, pupils need to be given opportunities to share and discuss subject learning if their confidence and motivation is to be enhanced.

When integrating different technologies, schools should recognise that ICT use can mean that pupils can work in different ways to those previously, so forms of homework can be revised. Different forms of and approaches to homework can then be encouraged outside as well as inside school. These different forms of working are motivating pupils positively.

Integrating ICT should also consider the impact upon motivation that can arise for different groups of pupils. If some pupils are poor attendees, they may well respond positively to ICT use early or late in the day. Uses of ICT that enable communication might support well those pupils who are disaffected with traditional forms of learning, or those who are at risk, initially, but then a focus upon information aspects should follow at an appropriate time. Gifted and talented pupils are likely to benefit from information aspects of ICT particularly, and ICT should be used to extend pupil learning for this group. Pupils who have difficulties with literacy should be encouraged to access ICT resources, particularly those that are internet based and offer digital content resources. Auditory and kinaesthetic engagement should be considered for pupils with limited literacy levels.

However, while ICT can have motivational impacts upon particular groups of pupils, access to ICT should be made possible for all pupils. Boys and girls are both motivated by ICT, but ICT may well have more of a shift on boys' patterns of working. Girls still benefit from ICT use, and access should be made available to them. Pupils with disabilities can benefit enormously from communication access through ICT, and use of appropriate ICT access resources outside as well as inside school should be ideally accommodated. Pupils from more disadvantaged socio-economic backgrounds may require particular support for wider use out of school, and access to specific software may be a particular need. There could be a great deal of value in supporting subject based out-of-school initiatives not only for the more disadvantaged groups in socio-economic terms, but for all pupils. Out-of-school uses and access should in this context be considered both at a subject and class level. ICT access and

provision now makes work and links with external agencies more possible, and greater involvement on this level could have a wider motivational impact upon pupils who are the focus for these groups and agencies.

Additional recommendations for leaders and managers in schools
To maximise motivation arising from the use of ICT, school leaders and managers need to consider professional development in the area of motivational impacts of ICT. This should include active consideration of the ways in which motivation itself is being conceptualised by teachers within the school. Good practice examples of using ICT and digital content to improve pupil motivation should be identified in the context of positive motivational measures, in the light of attainment outcomes and teacher perceptions of ICT impact, and shared with others across a school. Access to ICT should be ensured for all pupils, whatever their background. However, those from certain groups, such as those with English as a second language, those with SEN and those from poor socio-economic backgrounds may need access to specific software (although it should not be assumed that pupils from other socio-economic backgrounds necessarily have access to all software that is now needed to support educational endeavour outside the school). School initiatives to extend out-of-hours work with pupils is likely to be beneficial, and there is a great deal of scope for developing out-of-hours subject based initiatives. ICT access and provision now makes possible the development of partnerships and access with external agencies in different ways.

Additional recommendations for advisers
Overall, good ICT practice may well be concerned with using a range of technologies to support a range of learning needs, appropriate to a subject. Good practice examples need to be identified and disseminated. Ways for pupils to share and discuss subject learning within and outside school contexts need to be promoted. There is a great deal of scope for initiatives to extend out-of-hours work with pupils. Partnerships involving ICT beyond the classroom can benefit subject learning. Developing partnerships and access with other agencies is likely to be of benefit to stakeholders generally.

Recommendations for policy makers
Developing educational elements that take account of different motivational measures is likely to enhance pupil learning and motivation for learning generally. ICT can impact on the quality of work, but there needs to be more of a focus on uses of ICT to support internal cognitive processes as well as internalisation and externalisation processes, particularly in the light of the national strategies. ICT can impact on attainment, but the uses of ICT should impact upon internal cognitive processes more, and focus on subject learning, if attainment outcomes are to be fully realised. More investigation of subject attainment linked to teacher and pupil perceptions of effective uses of ICT should be explored. There should be a dissemination of highlighted effective practice.

ICT can impact on pupils' attitudes towards school work and behaviour in lessons, but effective practice should be highlighted and disseminated. ICT can mean that pupils can work in different ways to those previously, so forms of homework should be reviewed specifically. The use of ICT in planning, target setting, monitoring, and reward systems needs to be highlighted more. Exemplar guidance on school policies and practices should include a focus on uses of ICT by boys, girls, different ethnic groups, those from different socio-economic backgrounds, the gifted and talented, and those with disabilities. Pupils with disabilities can benefit enormously from communication access through ICT, and many find it essential.

Those disaffected with traditional forms of learning can benefit from using ICT. There should be an identification of effective practice followed by its dissemination. ICT can affect pupil attendance, and could potentially affect truancy, crime, and anti-social behaviour more in the future. Examples of cases where pupils with limited levels of literacy have accessed ICT resources, particularly internet based and digital content resources, and where these have led to changes in attendance, truancy, crime, and anti-social behaviour should be investigated further. Initiatives to extend out-of-hours work with pupils are likely to be beneficial and there is a great deal of scope for subject based initiatives. Partnerships involving ICT beyond the classroom should be a focus for further development and investigation, particularly developments with other agencies and how subsequent access can support pupils.

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Appendix 1: Details of evidence gathered to inform this report

Data gathering instrument	Numbers gathered
interviews with head teachers	12 in total
interviews with teachers	secondary school teachers, 43 in total primary school teachers, 21 in total special school teachers, 7 in total teachers in PRUs, 5 in total
interviews with classroom assistants	33 in total
interviews with parents	22 in total
interviews with pupils	primary school pupils, years 1 to 6, 33 in total secondary school pupils, years 7 to 13, 78 in total special school pupils, years 1 to 11, 10 in total PRU pupils, years 7 to 11, 5 in total
interviews with youth workers	3 in total
interviews with educational welfare officers	3 in total
interviews with health workers	2 in total
interviews with community workers	6 in total
interviews with careers officers	6 in total
interviews with police officers	4 in total
observations in classrooms	33 in total
questionnaires with pupils	secondary school pupils 788 in total, primary school pupils 418 in total
documentary evidence	17 sets, including school prospectus, school development and ICT plans, and any school specific documents that related to motivation or ICT use

Table 13: Evidence gathered to inform this report