Understanding the Impact of Technology: Learner and School level factors 2010

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Introduction

Understanding the Impact of Technology 2008 is one of three interrelated projects commissioned by Becta. It follows on from Impact 2007 and the personalising learning projects (Underwood et al 2007; Underwood et al 2008). It has a specific focus on capturing changes in e-maturity and personalising learning at the individual learner level.

These interconnected projects provide a robust evidence base for the impact of digital technologies on learning and teaching. They also serve as coherent, research-supported advice to key policy makers.

Impact 2007 tested a set of research tools that allowed a national level investigation of the conditions under which e-learning is effective in schools. In particular, it sought to identify the effect of the move to more personalised learning and the increasing use of digital technologies on standard measures of school performance.

While Impact 2007 operated at the institutional level, the focus of the 2008 research has been that of the individual learner. A further difference is that Impact 2007 drew data from e-mature schools, whereas this research sampled across the range, including schools of both low and high e-maturity.

Structure of the Report

The first part of this report focuses on the factors impacting on learner performance in national tests at primary and secondary level. This was the central research question of this research.

The second section focuses on teacher and learner perceptions of their own responses to learning and the learning environment. This was centred on, but not confined to, their school.

The institutional structures record the level of development of the schools sampled here and investigate the use of two key technologies – interactive whiteboards and learning platforms.

Methodology

The research methodology was that largely used in the Impact 2007 research. However, schools across a wider range of e-maturity were included in the sample. Measures of performance were taken at individual learner level, as well as at the institutional level.

Fifty-five schools contributed to the data and 25 schools provided all the required data. There were two main reasons for this loss of data:

1 Well-recorded difficulties with the 2008 SATs led to a serious reduction in schools providing those data to the project team.

2 Schools found it difficult to complete what at first sight appeared to be the fairly simple task of matching two sets of data (performance scores to questionnaire input). It was not clear from the returns whether this was due to poor information handling skills or issues around the usability of the management information systems in the schools.

Over 300 teachers responded to the questionnaires. The sample for learners was just under 4,000 learners with a 1:2 ratio of primary to secondary learners.

Alongside nationally held data of demographics and performance, online surveys of teacher and learner perceptions of aspects of the learning environment were completed by learners and teachers. This process used instruments that had been refined from Impact 2007. All the scales and sub-scales referred to here have robust reliability.

Glossary of terms

Challenge: the level of difficulty that is experienced by the learner in the tasks they are set.

Investment in learning: the level to which a learner takes part in the learning activities provided by the school. In particular, how much effort they put into learning and attaining good results in external examinations.

Learning space: the space in which learning takes place. This has some obvious physical characteristics, but crucially, it refers to the cognitive space in which the learner operates.

Maturity model: Maturity model frameworks provide a rich description of an institution and allow a self-assessment score to reflect the level of development at which they operate over time. This allows us to ask whether the designated institutions have the resources and structures to deliver effective educational experiences using ICT. Combinations of selected items from the maturity frameworks allow measures to be taken of the following:

- **e-maturity** – the organisational readiness to deal with e-learning and the degree to which this is embedded in the curriculum
- **o-maturity** – overall maturity is the pattern of performance on all of the maturity frameworks
- **p-maturity** – the organisational readiness to deal with the personalising learning agenda and the degree to which this is embedded in the curriculum
- **s-maturity** – school maturity is the level of development of curriculum and leadership in the school
- **t-maturity** – technological maturity is the degree to which the organisation has rolled out digital technologies such as learning platforms.

Opportunity for learning: the facilities and learning programmes designed to promote effective learning that are accessible by the learner.

Outreach: the number and range of activities offered by a school that provide facilities for and contact with the community.

Personalised learning: p-learning is the tailoring of pedagogy, curriculum and learning support to meet the needs and aspirations of individual learners, irrespective of ability, culture or social status, in order to nurture the unique talents of every learner.

Self-efficacy: a person's self-assessment of their ability to be successful at a given task.

Teaching space: the space in which teaching takes place. It includes the physical environment of the classroom and the cognitive structures that generate the learning environment.

Transformational technologies: technology that brings about a step change in teaching and learning.

Value of learning: the relative value that a learner puts on their formal learning in comparison to other goals or activities.

Summary of findings

Learners' investment in their own learning is critical to academic success but, this is enhanced by schools exhibiting maturity on a range of measures including e-maturity.

Institutions, teachers and learners all have differing perceptions of the impact of ICT and the level of personalised learning taking place.

These findings reinforce the findings from Impact 2007.

Performance outcomes

The move from school level to individual learner level analyses has refined our understanding of the contextual factors impacting on effective performance.

The overall maturity of the school was a positive predictor of performance. However, the importance of institutional maturity was dwarfed by the impact of the learner-focused factor of engagement.

Investment and challenge

The key predictors of performance proved to be learners' willingness to engage with the learning process and teachers' willingness to challenge the learner to do better. This was true across the age range.

Where girls outperformed boys, there was evidence that this difference was reduced by personalised challenge.

In contrast, at both primary and secondary level, learner perceptions of increased autonomy were associated with lower performance outcomes. This may be because increased choice places additional demands on learners who are already overloaded.

At secondary school level, girls outperformed boys in English, but there were negligible gender effects in mathematics or science. This lower performance for boys was already apparent in primary school, where girls had a clear advantage in writing and, to a lesser extent, in reading.

School level measures of deprivation were not strong predictors of performance. Rather, the characteristics of individual learners tended to underpin the pattern of performance.

There was little or no evidence that the percentage of learners from ethnic minorities had an impact on performance once individual learner characteristics were taken into account. These demographic factors are known to be important from national data. It seems plausible that these demographic factors have an indirect impact through

individual learner characteristics, such as engagement or personalised challenge. This is an important area for future research.

Impact 2007 found that e-maturity was a predictor of school level performance. This research found that individual performance was only weakly aligned to the school's e-maturity. However, at the individual learner level, attitudes to using computers (primary) and digital links between the home and school (secondary) were positive predictors of some aspects of performance.

Teacher perspectives

The perceived level of personalised learning reported by teachers showed no relationship to the level of e-maturity of the school.

A school's level of e-maturity was shown to have a strong positive relationship to the perceived effect of ICT on teaching, learning and outreach work reported by teachers.

The perceived impact of ICT on teaching showed variation between different subject specialisms, with primary teachers and ICT teachers reporting the greatest impact. Humanities, technology, arts and music teachers reported the least.

The perceived impact of ICT on learners showed a similar variation. Primary teachers and ICT teachers reported the greatest impact. Humanities, English and mathematics teachers reported the least.

These subject distinctions were mirrored in teacher perceptions of personalising learning.

Learner perspectives

The perceived level of personalised learning reported by learners was strongly related to the level of e-maturity in the school.

There was a worrying dip in the lower secondary school, centred on Year 9, in the perceived level of support for independent learning, personalisation and challenge experienced by the learner.

This was mirrored by lower reported levels of engagement with the school by learners. This was centred on Years 8, 9 and 10.

Institutional structures

High e-mature schools were not associated with areas of high socio-economic status, contrary to what might be expected.

Transformational technologies?

Two technologies, Interactive Whiteboards (IWB) and Learning Platforms (LP) are central to many schools' e-learning development.

IWBs were found throughout the age range, but LPs were less widespread in primary schools.

Many of the schools in this sample had made abortive attempts to install an LP. This frequently led to a level of disillusionment with this particular e-resource.

A number of primary schools were – in terms of LP introduction – at the planning stage only. However, where LPs had been introduced, the primary schools tended to be beacons of best practice.

While the IWBs were seen as an easy entry technology, LPs were often seen as problematic innovations.

IWBs were key to the spread of technology uptake across a school.

IWBs, while bringing efficiency gains, were seen as supportive of the current pedagogic practice. That is, they were not seen as transformational.

When an LP became embedded in the school, it proved to be supportive not only of efficiency gains, but it also stimulated new ways of working. This was true for both teachers and learners. In this sense, the LP *was* seen as a transformational technology.

Acknowledgements

The research team would like to thank the pupils, young people, staff and managers of all the Impact schools for their invaluable support throughout this project.

Key aims in understanding the Impact of technology

While the value of new technologies for learning is increasingly recognised, as is demonstrated by the Rose Report and others (Rose 2008; Johnson 2005; Green and Hannon 2007; Underwood et al 2007; Shaffer and Gee 2007), there remains a vociferous anti-technology lobby. This lobby argues that there is no substantial evidence for the optimistic rhetoric that supports educational use of ICT (Cuban 2001; Conlon and Simpson 2003; Oppenheimer 2003; Reynolds et al 2003). These researchers have drawn into question the large-scale funding that is currently being provided to support the spread of e-learning. They need to be answered with robust data if the policy of equipping our schools with technology is to continue.

While a body of anecdotal evidence or existence proof has been available for sometime ('I've seen it with my own eyes'), what one might term hard evidence has been limited at best. However, a body of evidence linking school and learner performance to e-maturity is emerging from projects such as the ICT Test Bed Project (Somekh et al 2007) and Impact 2007 (Underwood et al 2007). The purpose of the Impact 2008 project has been to add to that evidence base by specifically answering the following core questions:

- Are there any relationships between levels of e-maturity and personalising learning?
- Which, if any, of these relationships have a positive impact on learner outcomes?
- Does e-maturity alone have a positive impact on learner outcomes?
- Is the impact more discernable or significant for learners of particular abilities, gender or ethnicity?
- Can empirical models be developed to support the transfer of good practice?

From Impact 2007 to this research

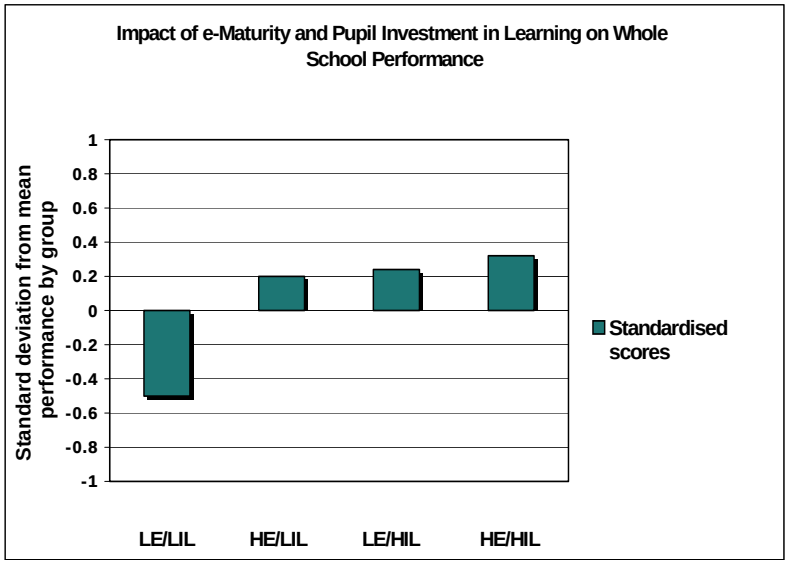
The Impact 2007 project (Underwood et al 2007) investigated relationships between levels of e-maturity, personalising learning and school performance. In so doing, we identified a measure of e-maturity that tapped into both the resource level within a school and the active use of that resource at the teacher and learner level.

E-maturity and learner performance

The data, collected at the institutional level, provided robust evidence of a relationship between e-maturity, school performance and investment in learning by learners. These two variables (e-maturity and investment in learning by learners) had a positive and additive effect on school performance levels. While schools whose learners showed low investment in learning (LIL) performed less well on national tests than those whose learners were engaged with their learning, this finding was ameliorated by the level of e-maturity. So schools, with high e-maturity, but low

investment in learning (HE/LIL) outperformed those schools with both low e-maturity and low investment in learning (LE/LIL). Schools with both high e-maturity and high learner investment in learning (HE/HIL) outperformed fellow institutions on a range of national tests (Key Stage 2 to A-level). This is shown in Figure 1.

Figure 1: Impact of e-maturity and learner investment in learning



In summary, Impact 2007 showed an additive effect of technology for learning in schools with an established technology base. The question for Impact 2008 was how robust was this effect when the evidence was drawn from a sample of schools across a wider spectrum of e-maturity?

For this sample, capturing the range from low to high e-mature schools, the impact of e-maturity, although consistently positive, was more tenuous. The key predictor of school level performance was the overall maturity (o-maturity) of the school rather than e-maturity.

The weakness of this finding may well have been a result of the overall number of schools contributing to this part of the data set. The well-documented issues that related to the 2008 SATs had a deleterious effect on data gathering. This resulted in

only 28 of the 55 schools delivering performance data on time and a consequent loss of statistical power in the analysis. However, aspects of technology did prove to be important at the individual learner level.

At primary school level, positive attitudes to using computers was a predictor of both reading and mathematical performance, but not how well a learner performed on tests of writing. At secondary level, performance in science was related to the quality and usability of the digital links between the home and school. The impact of technology on learning was more muted than in the 2007 study. It came through as part of the whole learning package, with both learners and teachers linking

personalisation of learning to the availability of relevant technology. In this sense technology was seen as part of the fabric of the learning process.

Personalisation of learning and learner performance

Personalisation of learning is a contentious concept. Even with the Impact 2007 schools, there were disparities in manager, teacher and learner perceptions of the usefulness and the level of personalisation in schools.

Impact 2007 found that the value of the personalisation of learning on performance was less clear than that of e-maturity. Personalisation of learning did not always relate to improved performance, particularly in high-performing schools where the level of personalisation was deemed to be low by the learners.

Key Stage 2 performance showed a positive relationship with primary teachers' reports of perceived personalisation, but higher GCSE scores were associated with lower ratings of perceived personalisation by secondary teachers.

Regression analyses conducted on the Impact 2008 data gave a more consistent picture of the relationship between personalisation and performance at school level. The variables of personalisation, personalised challenge and engagement predicted the school's average point score at all four key stages:

- KS1, adjusted R2 =0.53, $p < 0.01$
- KS2, adjusted R2 =0.64, $p < 0.01$
- KS3, adjusted R2 =0.59, $p < 0.01$
- KS4, adjusted R2 =0.64, $p < 0.02$

However, Impact 2008 was commissioned, in part, to establish why the discrepancies in the influence of personalisation on performance found by Impact 2007 occurred.

Questions that arose were:

- Were the discrepancies a product of assessment-driven teaching which restricted personalised learning?
- Did learners in high performing schools have unrealistic demands compared to their peers in more challenging environments?
- Were teachers in schools with lower performance levels using a more personalised approach to re-engage their learners?

In essence, this research sought to disaggregate the institutional and learner level variables. As for e-maturity, the effect of personalisation is masked by the contribution of o-maturity as the key predictor variable of school level performance. However, there were informative findings at the individual learner level. Learners' assessment that their teachers had constructed personally challenging environments

was a positive predictor of primary pupil performance in reading, writing and mathematics and for secondary students in mathematics. This finding resonates with a number of previous projects, which show that a sense of challenge is appreciated by learners. This might be critical for learner development, particularly in secondary school (Davies and Bember 1994; Harland et al 2003; Pell and Jarvis 2001).

A second measure of the level of personalisation, characterised as choice or level of autonomy, was a consistently negative predictor of performance. A likely interpretation of this finding is that offering learners too much choice leads to falling standards. Focus group data confirms that most learners thrive when their learning takes place in an educational environment that sets a clear framework for their learning.

In summary, learners at both primary and secondary level responded positively to educational environments that they perceived as personally challenging. However, more choice did not lead to better performance. Counter to some views more choice may prove to be a burden not a blessing?

Focus on the learner

Initially, Impact 2007 focused on the effect of the two key institutional level variables, e-maturity and personalisation, on school aggregated performance. However, it soon became apparent that learner attributes, particularly the learner's investment in his or her own learning, were the key predictors of this. Learner attributes proved to be of equal importance in the 2008 data analyses, which were conducted at the learner level.

In both primary and secondary schools, the willingness of any learner to engage with the learning proved to be the key learner-level predictor of performance. Persistence (which tended to correlate with value and self-efficacy) was a secondary factor differentiating primary pupils' performance in writing.

However, the individual learner data show disparities between learners, even within the same school and class. These differences have added considerably to our understanding of the circumstances under which successful learning outcomes occur.

Gender effects

There was evidence of different responses to the key variables outlined above for boys and girls. This is best exemplified by looking at the extreme ends of the performance range for Years 6 and 9.

Throughout these analyses, s-maturity, a combination of the curriculum and leadership maturity models, was a better predictor of performance than e-maturity, although the latter was closely associated with s-maturity.

Factors Impacting on Year 6 performance

The following examples assume a Year 6 pupil in a school with around 10 per cent free school meals (the mean on this measure in our sample is 9.72%). Year 6 is used to exemplify the interaction of factors and outcomes, but the pattern of data held across the primary school.

Reading: Learners responses to engagement, challenge and s-maturity by gender and level of performance

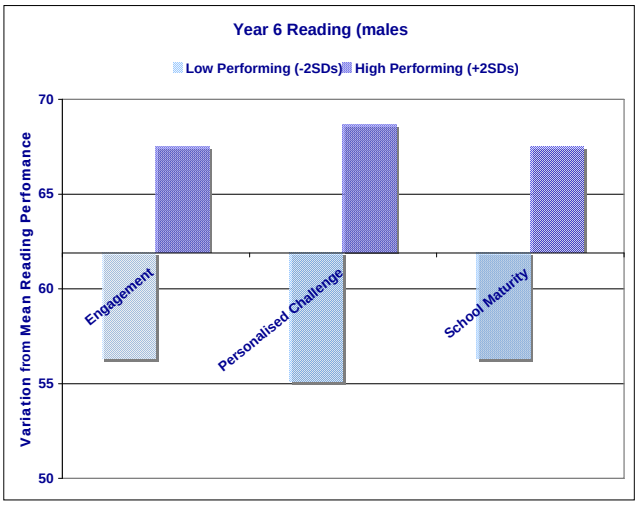
Typical mean performance out of a standardised score of 100:

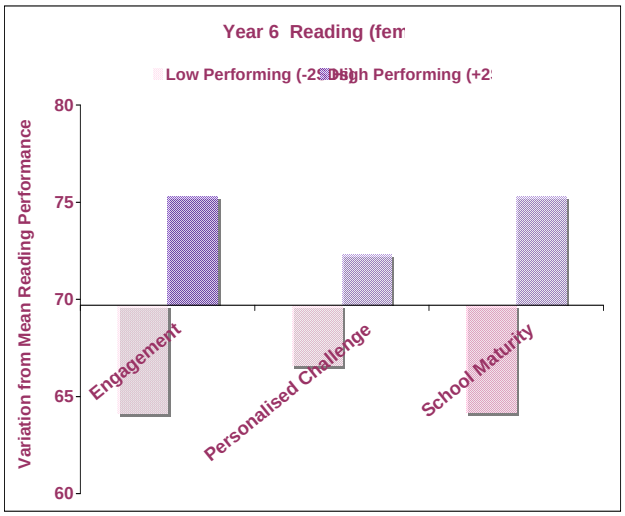
- female learner: 62.8
- male learner: 61.2

High performers in reading and mathematics at Key Stage 2 (pupils assessed as being 2 standard deviations above the mean performance level of all Impact 2008 Year 6 pupils), showed above average engagement with learning. They were also accepting of personalised challenge and were situated within schools exhibiting high overall s-maturity.

In contrast, low performers scored significantly below average on all these dimensions. They came from less mature schools and were less engaged with their learning and less accepting of challenge. This is shown in Figure 2.

Figure 2: Learner performance in reading





Mathematics: Learners responses to engagement, challenge and s-maturity by gender and level of performance

Typical mean performance out of a standardised score of 100:

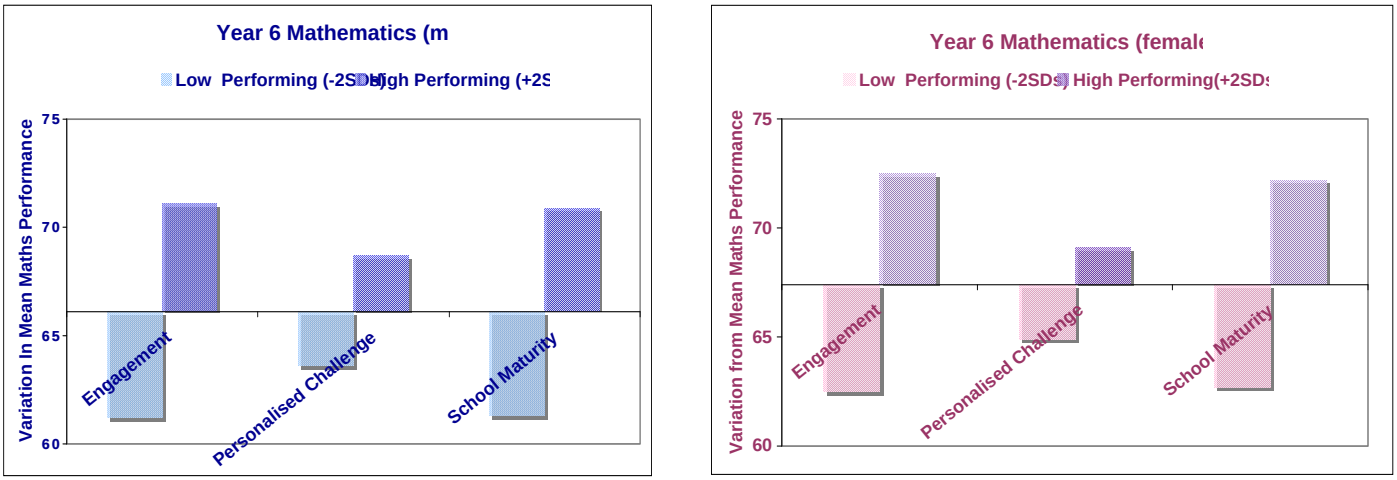
- female learner: 66.3

- male learner: 67.1

Although these overall differences between high and low performers were apparent for both males and females and for reading and mathematics, there was one notable gender difference. While acceptance of challenge was a key differential for boys when reading , the discrepancy in response to challenge for high and low performing girls was not large.

So boys need to be challenged and to accept that challenge if they are to succeed in reading but not mathematics. While girls' performances are less tied to academic challenge. They appear to perform for the teacher even when not challenged. This suggests there may be a fundamental difference in the importance of challenge for the girls.

Figure 3: Learner performance in maths



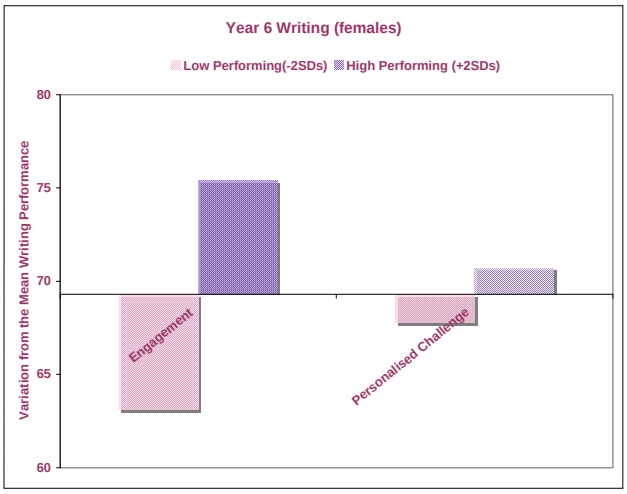
Writing: Learners responses to engagement and challenge by gender and level of performance

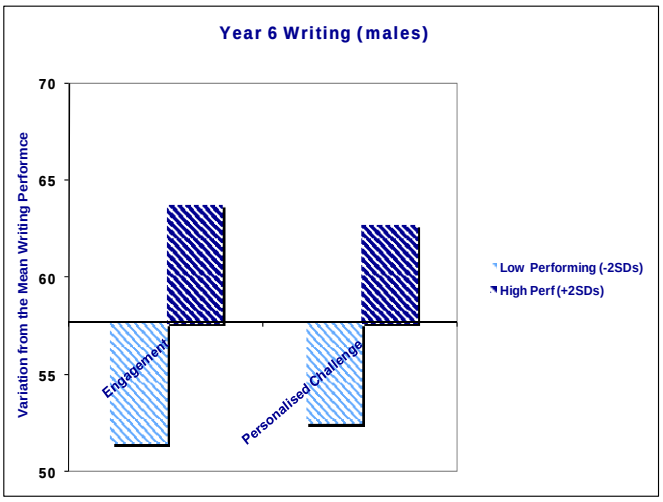
Typical mean performance out of a standardised score of 100:

- female learner: 58.0
- male learner: 53.6

Only two variables influenced learners' writing performance: engagement and personalised challenge. The s-maturity of the school was not a predictive factor. However, there was some disparity between boys and girls concerning the benefits of the level of personalised challenge in the educational environment. Boys' response to writing was strongly governed by the individual boy's response to the task. This suggests that this will be a more difficult performance indicator to change at the global level. This is shown in Figure 4.

Figure 4: Learner performance in writing





Factors impacting on Year 9 performance

The following examples assume a Year 9 learner in a school with around 17 per cent free school meals (the mean on this measure in our sample is 17%).

Due to differences in scoring of assessments at secondary level, it was not possible to match raw scores for SAT assessments across year groups. For this reason the analysis of secondary level reports a score expressed in terms of SAT level.

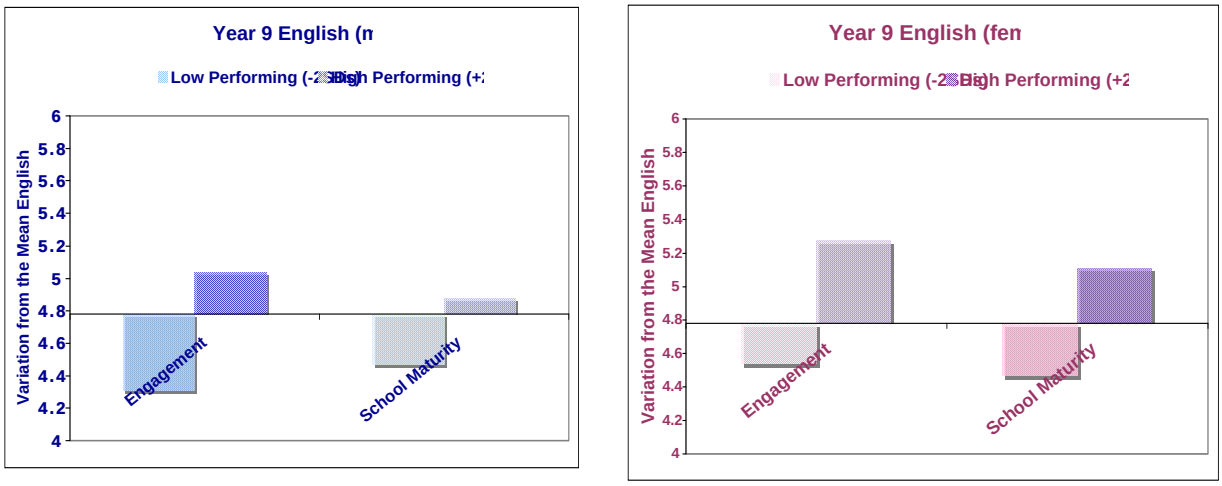
English: Learners responses to engagement and s-maturity by gender and level of performance

Typical mean performance expressed as an SAT level score:

- female learner:4.90
- male learner:4.67

As for writing performance in the primary school, only two variables influenced writing performance in English. These were engagement and s-maturity. Personalised challenge was not a predictive factor. Equally noteworthy, the gender differences so apparent in primary school are not apparent in secondary English. Figure 5 illustrates this.

Figure 5: Learner performance in English



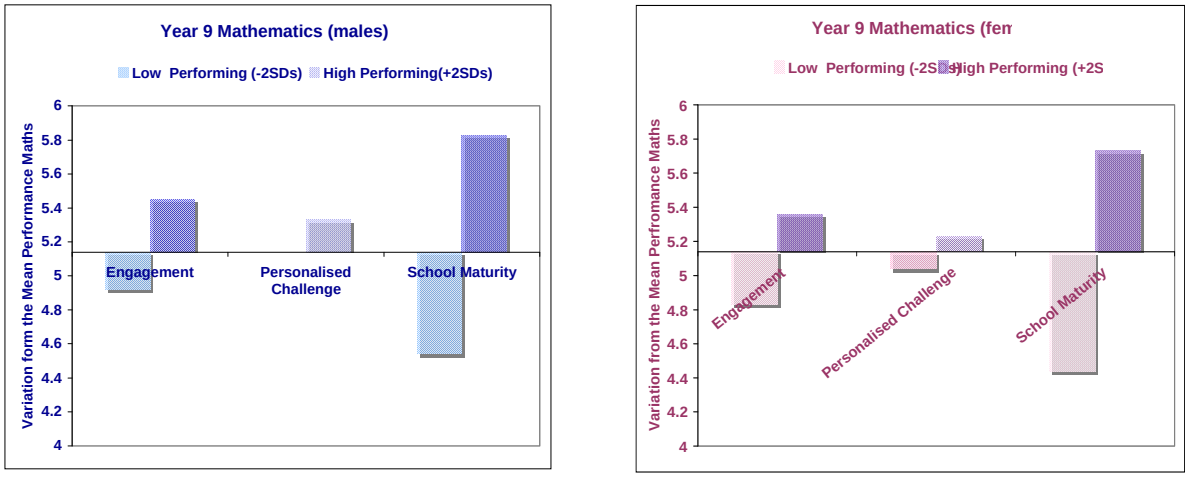
Mathematics: Learners responses to engagement, challenge and s-maturity by gender and level of performance

Typical mean performance expressed as an SAT level score:

- female learner:5.09
- male learner:5.19

High performers in mathematics at Key Stage 3 (learners assessed as being 2 standard deviations above the mean performance level), showed above average engagement with learning. They were also accepting of personalised challenge and were situated within schools exhibiting high overall s-maturity. This mirrored the findings for primary pupils. However, as for English, gender effects were not strong. This can be seen in Figure 6.

Figure 6: Learner performance in maths



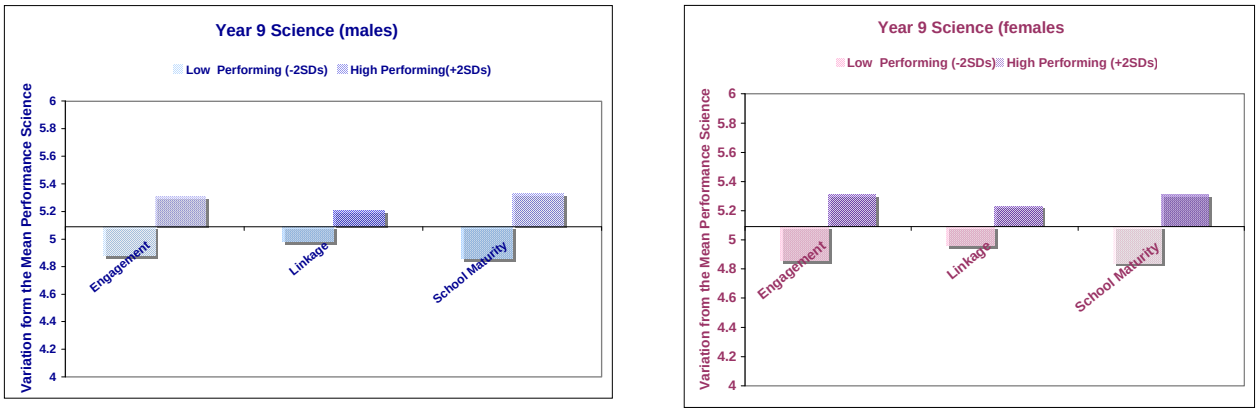
Science: Learners responses to engagement, linkage and s-maturity by gender and level of performance

Typical mean performance expressed as an SAT level score:

- female learner:5.08
- male learner:5.10

The crucial factor to emerge when examining performance in science is the importance of home school digital linkage. This is an intriguing finding that may be important to follow up in future research. Why should linkage impact on this one subject? We would argue that there are two likely connections. One concerns the quality of digital material available for science on the internet. The other is that linkage is a predictor of both a well-run school, but also an affluent home. This is shown in Figure 7.

Figure 7: Learner performance in science



Perceptions from the classroom

Online surveys of teacher and learner perceptions of aspects of the learning environment were completed by learners and teachers. This process used instruments that had been refined from those devised under Impact 2007. All the scales and sub-scales referred to here have robust reliability. The questionnaires took about 10 minutes to complete and the vast majority of teachers and learners who started the form went on to finish it.

Teacher perceptions

There were 331 respondents to the teacher questionnaire, of whom 66 per cent were female and 34 per cent were male. Some 29 per cent were from primary schools and 71 per cent from secondary schools. Teachers reported an average length of service of 12.0 years, with an average of 6.6 years service in the current school. No relationship was observed between teaching experience and any of the other variables.

There was just one measurable difference in the responses of male and female teachers; females reported more personalisation in their teaching (means, 51.8, 49.7, F=6.1, df 1,285, p<0.02).

Differences in the responses between primary and secondary teachers included:

- Primary teachers estimated the effect of ICT on learners as being greater than their secondary counterparts (means primary = 16.4, mean secondary = 14.8, F=22.0, df 1,326, p<0.001).
- Primary teachers perceived much more personalising of learning in their schools than their secondary counterparts (mean primary = 54.0, mean secondary = 49.5, F=31.4, df 1,287, p<0.001).
- Primary teachers reported more outreach using ICT in their schools than their secondary counterparts (mean primary = 12.0, mean secondary = 10.8, F=13.3, df 1,309, p<0.001).

A 'must-have' technology

Over 50 per cent of teachers identified the interactive whiteboard or a data projector as their 'must-have' technology. Interestingly, some teachers expressed unease with this position.

A further quarter of the teachers stated that their laptop was essential. Among the remaining responses, there were mentions for data sticks, Google, YouTube and CD players.

There were idiosyncratic rejections of digital technologies, but only one direct challenge: "None. I don't need technology to teach. A good teacher can just teach!"

The change from the data collected in Impact 2007 shows a large shift away from the laptop towards interactive whiteboard/data projector technology. The latter had been identified by only a quarter of teachers in the earlier survey as their most valued technology.

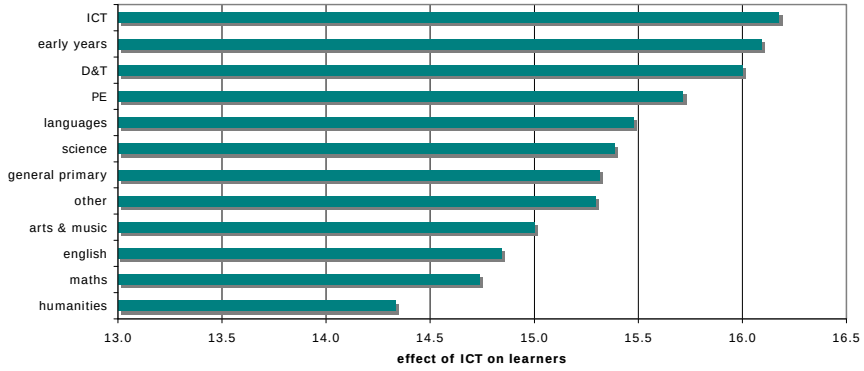
The request to 'identify 3 most valued online resources' attracted 645 responses, with a much wider variety of suggestions than those found in Impact 2007. The most commonly mentioned resource was the BBC (13% mentions), followed by Google

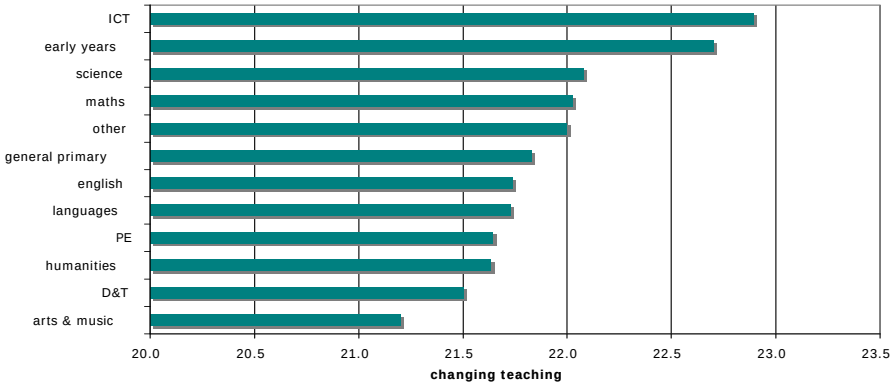
(9%) and primary resources (6%). There was support by teachers for their own LP and also for the resources from other schools.

Teachers were asked how much they thought ICT had affected the way they taught and also how much impact there had been on learners. Figure 8 shows how teachers from different subject areas responded to these questions. The most positive responses to both questions came from Early Years teachers and ICT specialists (perhaps not surprisingly). Among the least positive about the effect on

teaching were humanities teachers who were also least positive about the impact on learners.

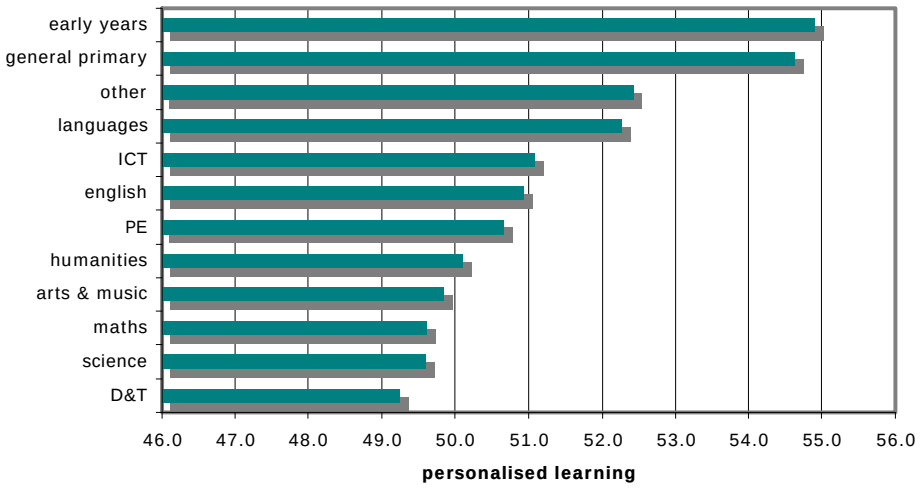
Figure 8: Teachers' responses on the impact of ICT





When asked the extent to which their school promoted and supported personalised learning, the least positive were teachers of science and mathematics. The most positive were primary teachers, as shown in Figure 9.

Figure 9: Teachers' responses on personalised learning



Teachers were also asked about the impact of ICT in their school and they invariably were positive about it. Some indicative responses are shown below:

How does ICT affect teaching learners of varying abilities?

"At the most basic level it allows the students to differentiate work themselves to their own level, but when used correctly it allows students to discover their own learning preferences and enter a personalised world of education. This is the ideal, and it is something I'm working towards, but in reality at the moment the wealth of resources available to support this is not there yet."

In your opinion does ICT help (or hinder) the teacher to provide personalised learning?

"A great aid. I have a number of children with visual impairments – I can quickly set up their personalised resources without spending hours at a photocopier getting loads of different colours of pieces of paper. Ultimately I can provide personalised learning, as I slowly build up banks of suitable resources, but to a certain extent the quality of the learning is entirely dependent on the attitude of the student."

Over the last two years, what have been the major changes in the way staff use ICT in the school?

"Confidence has grown considerably. This has been enabled by allowing all teachers to buy into some form of e-learning. Staff are encouraged to choose from a wide variety of e-learning options: whether it be first steps in creating engaging personal resources, taking advantage of more effective use of our e-mail system to the more advanced incorporation of personal mobile technologies in a lesson or creating a fully trackable online course on the LP."

The level of e-maturity in the school was related to the teacher reports about the impact of ICT. For example, higher e-maturity related to teacher reports of:

- the effect of ICT on teaching ($r = 0.42$, $p < 0.01$)
- the effect of ICT on learning ($r = 0.46$, $p < 0.01$)
- outreach work by the school ($r = 0.64$, $p < 0.001$)

However, there, was no relationship between e-maturity and teacher reports of personalisation.

Learner Perceptions

We collected responses from 1,336 primary pupils (669 girls, 651 boys, 16 not reported) and 2,541 secondary students (1,251 girls, 1254 boys, 36 not reported) as is shown in the table below.

Number of responses by year group

Year group	No. of responses
2	34
3	180
4	255
5	338
6	529
7	579
8	732
9	580
10	254
11	309
12	43
13	36

Gender differences

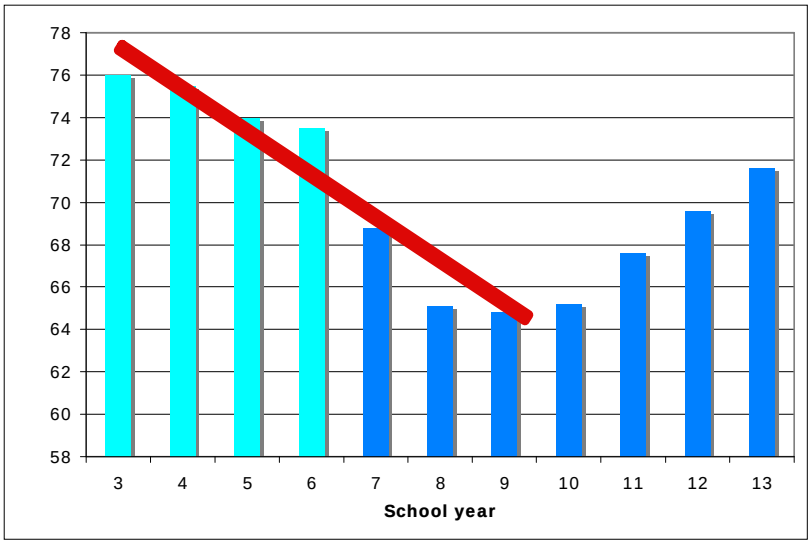
There were several marked differences in the responses of primary learners. Girls reported more choice and support for their learning (means 20.9, 19.8, $F=27.2$, $df= 1, 1260$, $p < 0.001$) and more engagement in their learning (means 21.9, 20.7, $F=21.8$, $df= 1, 1182$, $p < 0.001$). They also showed small but significant positive effects in self-efficacy, the value they placed on learning and their persistence.

There were fewer gender differences at secondary level. Boys were more positive about using computers at school (means 19.4, 18.5, $F=51.73$, $df= 1, 2413$, $p < .001$). Boys also reported small but significant positive differences in the level of personalisation they experienced and the level of challenge in their learning.

Year group differences in perceived personalised learning

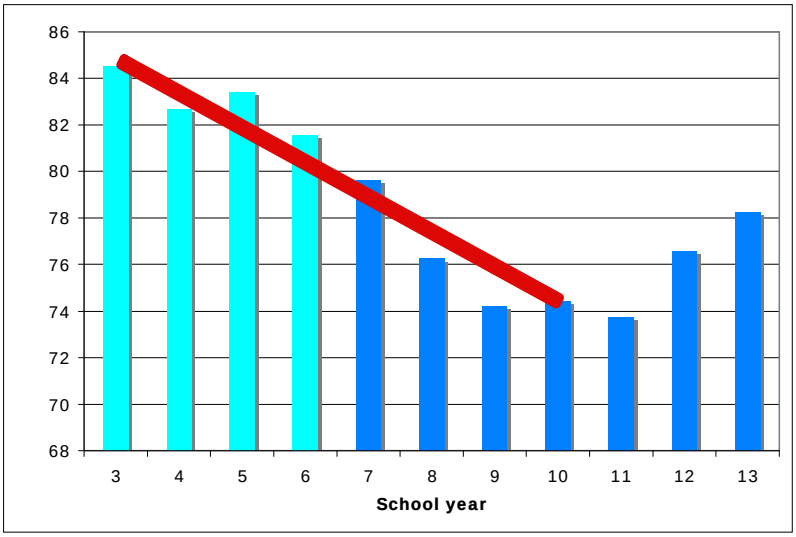
Among the interesting trends is the change in learners' perceptions of levels of personalised learning across the school years. This is shown in Figure 10. It indicates a surprising decline in perceived levels of personalised learning from early years through to secondary school, before this perception rises again in post 16 studies.

Figure 10: Learners' perceptions of personalised learning



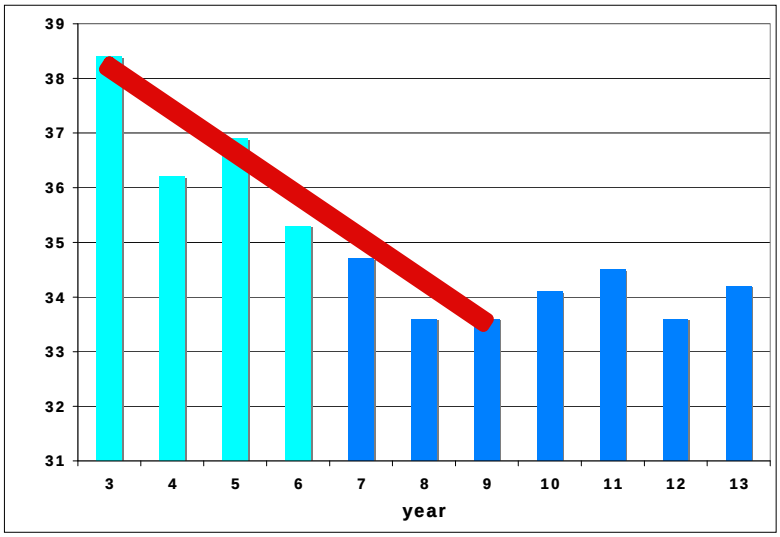
The same trend can be seen in learner reports on the level of challenge they experience in their work at school. This is shown in Figure 11.

Figure 11: Learners' perceptions of the level of challenge



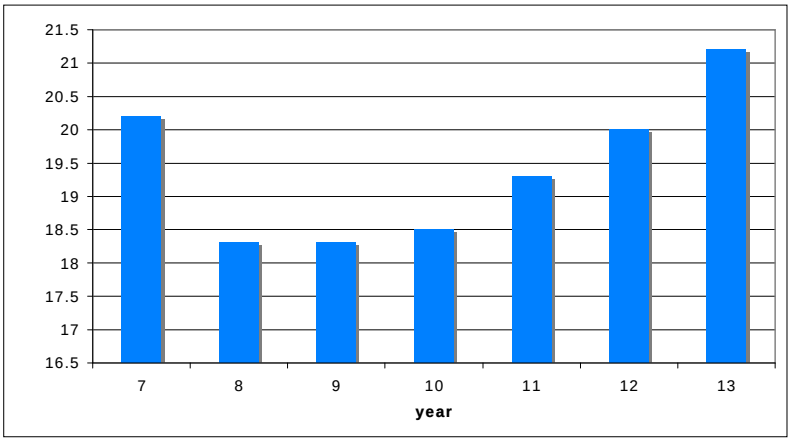
There is a similar trend in reports of engagement with learning. There is a steady drop through primary school, reaching a plateau in the early secondary years, before rising as the GCSE assessments approach. This is shown in Figure 12.

Figure 12: Learners' perceptions of engagement with learning



Another surprising trend can be seen in the reports by secondary learners of support and choices in their learning (example question, 'I feel supported by my teacher to do well in my school work'). The perceived support falls away dramatically after Year 7, before rising again in Year 11. This is shown in Figure 13.

Figure 13: Learners' perceptions of support



In summary, there was a worrying dip in lower secondary school. This centred on Year 9 learners' perceptions of the level of support for independent learning, personalisation and challenge they experienced.

This was mirrored by lower reported levels engagement with the school by learners, which centred on Years 8, 9 and 10.

Institutional Structures

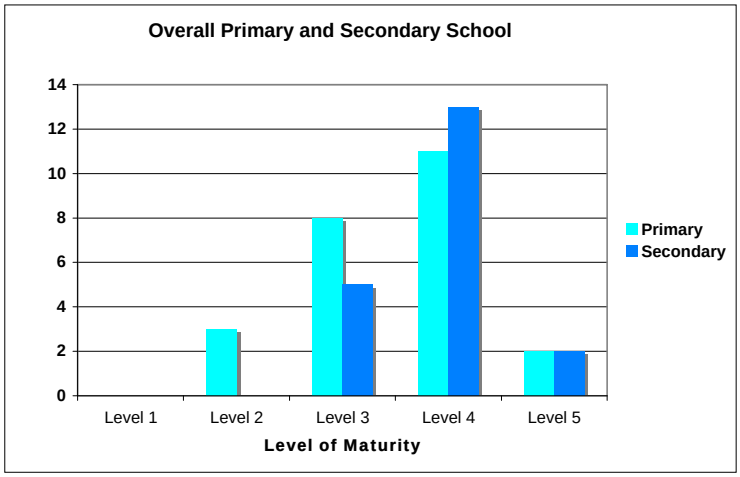
Institutional Maturity

Schools' self-assessment of their stage of development (maturity levels 1 to 5) on a range of measures was captured using the maturity model framework (Underwood and Dillon 2004).

Unsurprisingly, this voluntary sample is weighted towards the high end of the maturity range. All but three schools in the sample were rated average or above average. Schools that showed low levels of maturity were reluctant to engage in processes deemed to be evaluative of their practice.

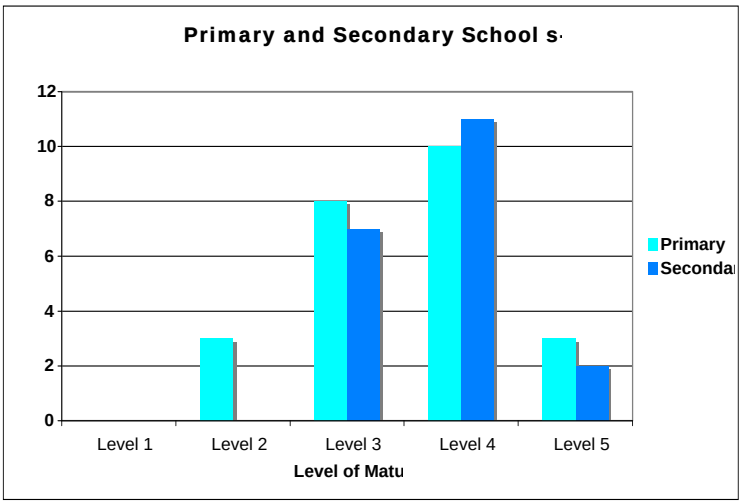
As for the Test Bed Project (Somekh et al 2007), secondary schools rated their overall progress more highly than primary schools. This was confirmed by independent ratings. There were, of course, very highly developed primary schools, but the tail of the distribution was greater than that for secondary schools as Figure 14 shows.

Figure 14: Patterns of overall maturity



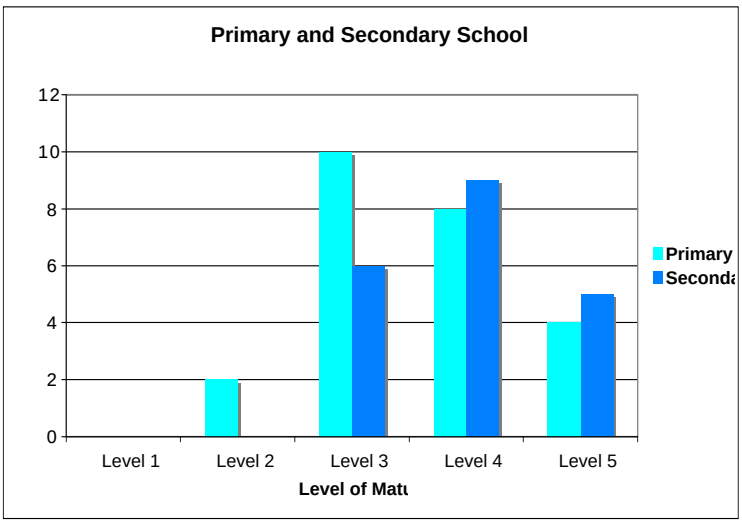
The pattern for s-maturity (leadership and curriculum development) mirrored that for overall development as shown in Figure 15.

Figure 15: Patterns of school maturity



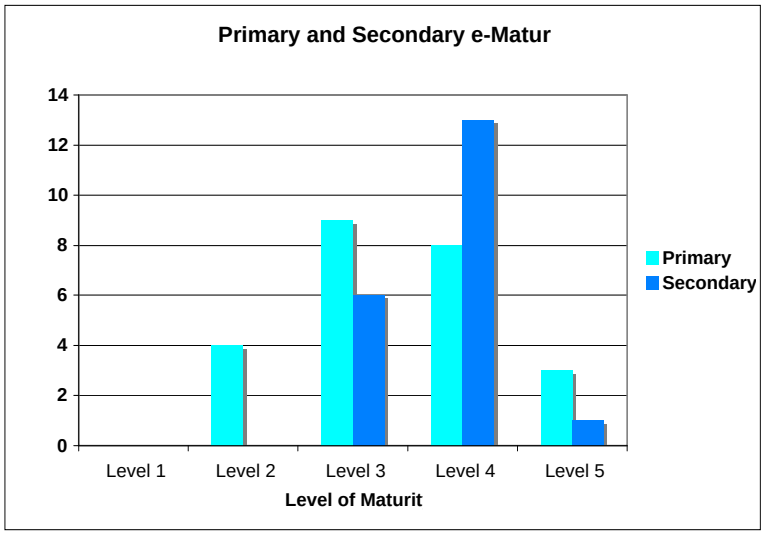
While the personalisation of learning showed a more equitable distribution between primary and secondary schools, there were still two primary schools self-assessing as below average. This is shown in Figure 16.

Figure 16: Patterns of maturity in personalisation



The disparities between primary and secondary schools outlined above are relatively minor. However, the pattern was more pronounced when the level of e-maturity and LP-maturity was considered. This is shown in Figures 17 and 18.

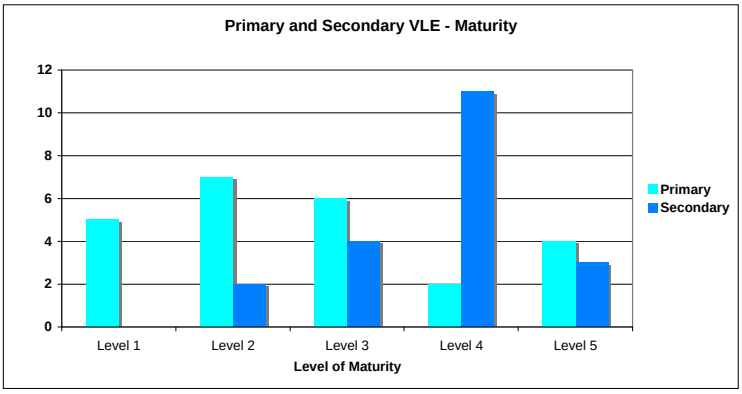
Figure 17: Levels of e-maturity



Again, although there were primary schools with a high e-maturity score, the tail was more pronounced. Also, while Level 4 was the modal score for secondary e-maturity, it was Level 3 for the primary sample.

This disparity was very clear when we examined the stage of development of each school's LP. Figure 18 shows that secondary schools reached modal Level 4, while primary schools reached Level 2. For some primary schools the slow development in this area was the result of a strategic decision. LPs were not seen as central to the school's ICT policy and they certainly sat below the need for IWBs in every classroom.

Figure 18: Levels of learning platform (LP) maturity.



Please note that VLE means learning platform (LP) in this instance.

Transformational technologies or more of the same?

Two technologies, Interactive Whiteboards (IWBs) and Learning Platforms (LPs), were central to our examination of e-maturity. While the former proved to be ubiquitous and were embedded into the majority of sample schools, the latter has had a more chequered development.

The Interactive Whiteboard: A 'must-have' technology

Staff in the sample schools cited the introduction of IWBs or the purchase of additional IWBs as a major development strategy. For many schools an IWB in every classroom was a clear aspiration. The IWB was seen as a 'must-have' technology, essential to current pedagogic practice. According to market research by Futuresource Consulting, one in every seven classrooms in the world will feature an interactive whiteboard by 2011.

However, the rationale for this perceived desirability is not straightforward. For many schools, the IWB was seen as a Trojan horse to entice the less-ICT literate teachers into engaging with the technology. Once initial steps were taken using the IWB, such staff could and would be encouraged into using other ICT-based facilities.

"The limited use of equipment was a hindrance; therefore the introduction of IWBs and the network suite has provided staff with greater opportunities." (Primary School 5)

Once teaching staff became accomplished in using an IWB, the possibilities for employing other forms of technology to facilitate teaching and learning could be explored.

"Teachers are more confident and skilled in use of ICT. Recognition that ICT across the curriculum is more than using the whiteboard. Desire to use different forms of technology to facilitate learning." (Primary School 30)

Low e-mature schools, in particular, saw the introduction of IWBs as both a manageable and an effective way to embed ICT across the curriculum. One school stated that the IWB was:

"a predominant factor in each session now." (Primary School 7)

But is it transformational?

Becta's own research review (Cranmer and Selwyn 2008) outlined a number of positive outcomes from teaching and learning supported by IWB technology:

- increased enjoyment and motivation for the learner
- greater opportunities for participation and collaboration
- improved personal and social skills

- less need for note-taking
- ability to cope with more complex concepts
- accommodation for different learning styles
- increased self-confidence.

This research has also recorded benefits from effective use of IWBs. It is apparent that this technology has the capacity to bring lessons to life, making them much more enjoyable for the learner.

“Whiteboard use is becoming much more embedded. In some departments they’ve matured from using them for presentations to using them more interactively – for example in maths where there’s some excellent practice using whiteboards interactively in lessons. RM have a video about the use of IWB in maths. They do other things like using Nintendo DS for BrainGym activities – the kids love it, they have a 10 minute session at the end of the lesson.” (Secondary School 22)

“Smartboards used as a tool for teaching. Has a significant impact on motivating pupils. Supports different learning styles. Videos, interactive materials” (Primary School 11)

“IWBs have been key – brought lessons to life.” (Secondary School 6)

Negative responses to IWBs in teaching were far fewer than for other major ICT resources. This contrasted sharply with many teachers’ perceptions of their school’s LP. One teacher raised a privacy issue regarding IWBs. They had noted that the email system could be accessed via the IWB, so learners could gain access to teachers’ emails. The solution was to remove the email facility.

There is no doubting the immediate appeal of IWBs. They have certainly facilitated cross-school use of ICT. They resonate with teachers and can be effective tools for enhancing professional practice. For many teachers this technology has brought efficiency and for others it has changed the way they interact with learners – in a positive way. However, IWBs are not strongly linked with transformational pedagogies or learning.

“There are varying levels of ICT usage among staff; many remain very basic, using email and planning resources for the IWB only. While 90 per cent use the IWB for the majority, ICT usage does not extend beyond this. Email is low usage.” (Secondary School 33)

In some schools, teachers did not appear to be employing the full functionality of the IWB and little interactivity was evident.

“Smart boards are located in every teaching area. A recent survey of students on the use of technology for learning suggested that in the vast majority of lessons it was

mainly for display purposes but a growing number of occasions suggests they are being used in an interactive way with students." (Secondary School 52)

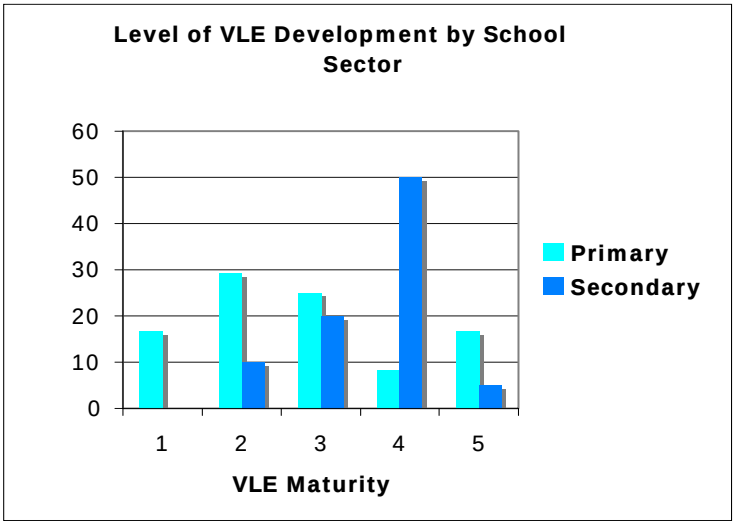
This resonates with the finding that children are frustrated by teachers' restrictions on the use of the IWB by learners (Somekh et al 2007).

The learning platform: a technology in transition

In contrast to the ubiquitous distribution of IWBs, the use of LPs is still in its infancy for many schools. There is an observable sector divide in the stages of LP implementation, with secondary schools progressing faster than their primary counterparts.

The aspiration that by 2010, all schools will have integrated learning and management systems seems achievable for the secondary sector. However, this may be somewhat optimistic for primary schools, as Figure 19 shows.

Figure 19: Level of learning platform maturity by school sector



Please note that VLE means learning platform (LP) in this instance.

Many of the schools in this study have declared a three-year implementation plan for their chosen LP. This includes staff training, uploading appropriate resources and embedding the technology within the curriculum. Some schools have achieved this integration process already and are using a fully embedded system. For schools that are satisfied with their chosen LP, but have only recently embarked on a process of integration, another two to three years implementation is required before the system is fully functional. Unfortunately, many schools in this sample were still trialling and rejecting systems or awaiting decisions from their local authorities on which platform to formally adopt. Once a decision has been made, a period of integration will commence, which will inevitably extend beyond 2010.

An intermediate target for 2008 is that all learners should have access to a personalised online learning space with the potential to support e-portfolios. While

personalised learning spaces were discussed enthusiastically by school leaders (either as a reality or as a desirable resource), e-portfolios were mentioned rarely, suggesting that they were not high on the agenda for most schools.

Although primary schools in general lagged behind their secondary counterparts, schools that have reported a high success rate of their chosen LP are from both primary (four schools) and secondary sectors (three schools). These schools are skewed towards less prosperous areas. They are also using LPs that provide structure, but not necessarily content.

While there is a core commonality of experience in using an IWB, it is clear from the schools in this project that teachers and learners have had very different experiences of working with an LP. Some of those experiences have proved to be positive, but many have not.

This is not the case of a resistant profession that is unwilling to respond to new technology. Teacher assessments of the LP concept were largely positive. They recognised the potential of the LP to contribute to their professional practice and (when successfully embedded into the curriculum) to greatly enrich learning. This is not achieved, however, when the chosen system is not compatible with the school and teaching practices in place.

LPs: When do they work?

The staff within these schools clearly identified the key characteristics of a functional LP:

- **Works with and not against current pedagogic practice** – The chosen LP supports the working practices within the school. This is an entry-level criterion which resonates with the ease of adoption of IWB technology.
- **Easy-to-negotiate, reliable and intuitive** – It was clear that LPs that were deemed user-friendly and provided the support needed, had higher rates of use within the schools.
- **Early identification of a fit-for-purpose system –** Many schools have reported trialling this technology and it failed to offer the attributes of an LP identified here. Negative experiences of LPs resulted in a level of disillusionment. Recovery of goodwill often proved difficult. Early identification of a usable platform maintained enthusiasm among staff and learners.
- **The local authority policy –** The majority of schools with fully functioning LPs had knowledgeable local authority support in the choice and implementation of their LP. However, not all authorities had effectively put their LP policy into operation. Initial delays in selecting a system, often followed by decisions to change, meant that schools were unsure as to whether to wait for the authority's decision or to independently determine a

suitable system. While educational independence can be a boon, the cost in time, money and goodwill of such aborted implementations is a concern.

- **Three or four-year programme of implementation -** Schools agreed that it took several years to embed the LP in their practices.
- **Staff training** – While staff training for the IWB was seen as desirable, it was seen as essential in using the LP.
- **Time scheduled to develop LP materials –** One headteacher was building time into staff schedules to update and maintain their areas on the LP. Without this, workloads could have been increased greatly.
- **Learner-centred –** A common complaint of rejected LPs was that they were teacher-oriented. Although such LPs facilitate planning and delivering lessons, teachers felt that such tools were in conflict with the personalising learning agenda. It was argued that there should be the opportunity for learners to set their own targets and workloads and use the LP to organise their learning effectively.
- **Interactive:** – Teachers and learners should be able to upload, mark and provide feedback online. Other examples of positive interactive areas on LPs include discussion forums (enabling the learner voice to be heard), email and social networking facilities.
- **Flexible –**There should be opportunity for teachers to build a resource base tailored their teaching objectives. Open source systems, such as those that were Moodle-based, were viewed positively. Such systems were popular as they are content-free on delivery, enabling schools to create a personal LP within a usable framework.
- **Embedded –** In those schools where the LP was used school-wide, reports from teachers and learners were increasingly positive.
- **Supported –** One school trained ex-learners as e-moderators to provide LP support to learners outside school hours. They regulated forum discussions, suggested useful links, monitored language, content and so on. This high level of learner support was well received and the LP is a major resource in the school.
- **Maintained –** Whether this is done by a school technician, an ICT co-ordinator, the head teacher, the local authority or the company providing the portal, a reliable system is essential to encourage effective learning and positive attitudes toward the LP.
- **Accessed remotely** – If the system is being used to provide and store work, it needs to be accessible from home. This also provides the opportunity for families to become involved in children's learning.

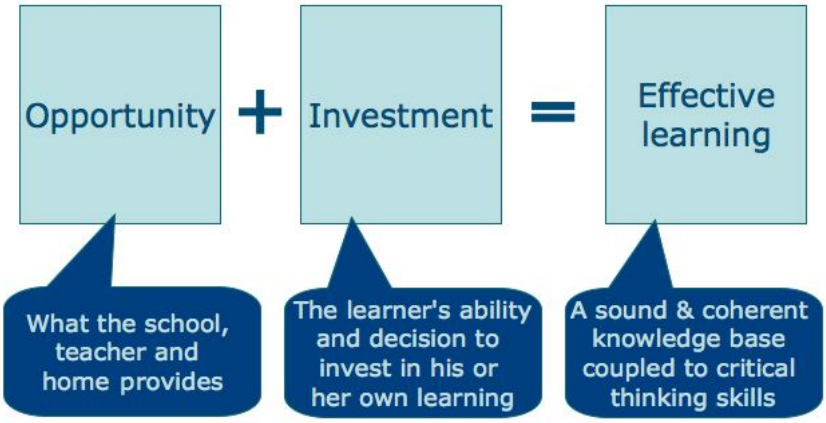
"The LP has been a major influence in developing the personalisation agenda. Teachers can tap into or tailor for small groups of learners. The parents are involved therefore there is a whole group approach to learning, and it helps parents to understand where the learners are. The teachers planning and assessment has

always been good, but the LP has focused the mind and sharpened the offerings." (Primary 28)

The Learning Equation

The data from the Impact 2007 study led us to construct a simple, but powerful model of effective learning. This is summarised in the Learning Equation.

In this model, the educational institution provides opportunities for learners to learn using resources that include good teachers and technology. The potential value added by these resources is diminished, unless the learner has both a desire to learn and the social and cognitive skills to take advantage of the opportunities on offer.



Digital technology must be attuned to learners' experience, expertise, previous knowledge as well as their interests (Holzinger et al 2008). In the Impact 2007 research, investment in learning was constructed from a range of factors including learners' work ethos, self-efficacy, motivation, engagement and overt behaviour. These two variables, digital technology and the learner's investment in learning, had a positive and additive effect on school performance levels.

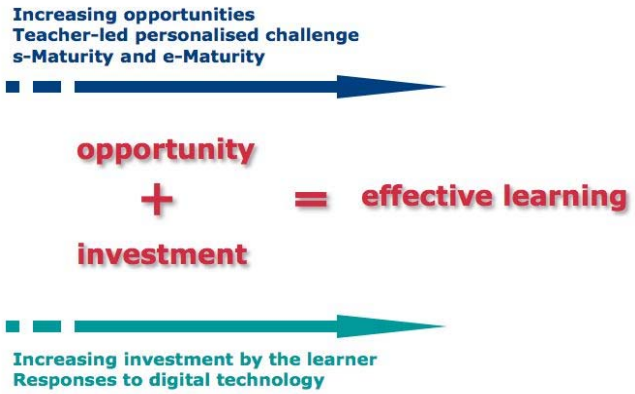
A question for this research concerned the validity of the Learning Equation and whether further development of the equation was possible. The current 2008 data show that performance on national tests is predicted by learner engagement as well as the nature of the learners' response to an educational challenge. Such challenge, of course, needs to be provided by teachers within each school.

There was a difference in response to personalised challenge between the sexes at primary school level, which was not the case at the secondary level. Primary school boys did well in educational environments that challenged them. Although personalised challenge was also a predictor of success for girls, it was of less importance than for boys. At secondary school, challenge was important for both sexes and the acceptance of challenge led to performance gains.

A positive response to technology was an additive factor in successful learning.

These findings support and extend the initial learning equation. They also highlight two key areas. The first is the importance of individual learner characteristics, including engagement with learning and with technology. The second is the level of personalised challenge that is orchestrated by the school and the responsiveness of the learner to that challenge. Figure 20 shows the extended Learning Equation.

Figure 20: the extended Learning Equation



The findings of this research support the Rose report (Rose 2008). This talks of the need for ambition in our classrooms. We interpret this as ambition from the learner, the teacher and the school.

Effective learning is a partnership of the willing to engage and to accept challenge.

Implications for future research

The importance of challenge as a predictor of performance and attitude suggests that we need to explore those characteristics of learning that provide and maintain a level of challenge for the learner.

This research confirms the findings of Impact 2007 concerning the necessity for learners to show investment in their learning in order to achieve. We need to explore how best to boost and maintain the investment in learning.

The challenge of ICT in learning is to create assessments that allow learners to show their knowledge and understanding. It is questionable whether current external assessments capture the richness of the learning experience provided by ICT. We need to explore ways of assessing achievement that include many areas currently unrecognised and unreported by current methods.

The effect of deprivation on the performance of learners is complex. For instance, few would dispute that a digital divide exists. Finding ways to reduce the effects of the digital divide will require further study.

The varying responses of teachers from different subject areas to ICT, also requires further study. We need to know where aspects of curricula are inhibiting the development of ICT-based learning and where there is resistance within the profession.

While good practice examples show progress in individual curriculum areas, the degree to which ICT is embedded across the curriculum is less clear.

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