

# Research for Teachers

## Transforming teaching and learning with ICT

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### **How might we use ICT in ways that make a real difference to teaching and learning?**

There is a vast array of new technologies currently available, such as the internet, internet-look-alike CD and DVD materials, digital imaging and video. Could we use them to bring about similarly innovative and effective changes in the way we approach teaching and learning? How might we make the experience of ICT in school as alluring to pupils as their use of ICT at home? And what difference would it make? This TLA research summarises a project that set out to explore these issues.

The summary is a little different to our usual summaries because the project it focuses upon was a research and development project. By its nature, this was exploratory work. The university researchers worked with teacher-researchers at four schools over two years to develop innovative teaching and learning strategies involving ICT. A university researcher made video recordings of the learning events which the pupils and teachers were invited to comment on. In the third year the new models of ICT use were successfully adopted and customised in twelve other schools.

Whilst there is no quantitative data (in terms of, for example, end of Key Stage test results) of the impact of the new approaches on pupil learning, teachers' assessments showed very positive outcomes, particularly in cases where they took place after several months to test pupils' retention of skills and concepts. We feel this research offers a rich portrait of learning potential. We hope that in time, further research will be done in what looks to be a promising area.

With the Pedagogies with E-Learning Resources (PELRS) project teachers planned learning events for their students which allowed the students to decide on their own learning activities and choose resources to help them from books and e-learning materials, including the internet. The students then created presentations.

The approach exploited pupils' own knowledge and fascination with ICT, and changed the teachers' role from being 'founts of knowledge' to being facilitators of learning. At the same time, it gave the children the

opportunity to be creative and take responsibility for their own learning.

The research found that when pupils worked alongside teachers to plan how learning would take place, and could use technology as they wished, their motivation and performance improved. For example, a group of Year 9 students made a video about their school in German, with the aim of sending a copy to their partner school in Germany. The students scoped the project, creating storyboards, scripts, and directing filming. The teacher noticed how students, who ordinarily would not speak German in class, felt comfortable in front of the camera, and were highly motivated to use the language accurately.

Both students and teachers welcomed the change in approach. One teacher commented:

*'I'm convinced that when the pupils work with the laptops using the internet to find resources and then put it all together to make presentations, they learn far more than when I sit them down and speak to them all at once'.*

In this summary, we explore how:

- the teachers changed the way they organised teaching and used ICT
- the teachers encouraged student ownership of their learning
- students benefited from the change of approach, and
- teachers who lacked confidence with ICT particularly benefited from the approach.

Selected case studies illustrate the ways students took responsibility for their learning by, for example, choosing the software they wanted to use, making short films to explain key scientific topics, teaching each other and using information found on the internet to create presentations.

We think that practitioners at both primary and secondary level who are seeking ways of personalising learning and encouraging pupils' creativity will find the material in this summary helpful.

Somekh, B. *Pedagogy and learning with ICT: Researching the Art of Innovation*. Routledge, 2007.

Somekh, B. & Saunders, L. (2007). 'Developing knowledge through intervention: meaning and definition of 'quality' in research into change.' *Research Papers in Education* 22 (2) pp. 183-197.

Pearson, M. and B. Somekh (2006). 'Learning transformation with technology: a question of sociocultural contexts?' *International Journal of Qualitative Studies in Education* 19 (4) pp. 519-539.

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## Overview

### **Why is the issue important?**

The researchers wanted to explore with teachers ways of using new technologies (the internet, internet-look-alike CD and DVD materials, digital imaging and video etc) to bring about similarly innovative changes in teaching and learning.

### **What did this research and development project achieve?**

The project helped teachers 'transform' learning with ICT and illustrates how they went about it. This involved students in:

- learning creatively - contributing, experimenting, solving problems
- learning as active citizens - acting autonomously, taking responsibility for their own learning
- engaging intellectually with powerful ideas, using thinking skills, grappling with ideas/concepts
- reflecting on and evaluating their own learning (metacognitive strategies).

### **How was this achieved?**

The project teachers planned learning events in which students were given freedom and choice about which ICT resources to use and how they should be used. Together, the researchers and teachers developed four strategies:

- pupils as teachers
- pupils as media producers
- pupil voice
- learning online.

The aim with all four strategies was to change the traditional roles of teachers and learners - from teacher-led to student-led - through emphasising co-learning between them.

### **How was the research designed to be trustworthy?**

The project was exploratory. Initially, the research and development team worked in partnership with teachers and pupils in four schools (two primary and two secondary) over two years to develop examples of successful, innovative changes to teaching and learning practices with ICT. The teachers planned and implemented the learning events. A university-based researcher worked alongside the teachers and pupils, making video recordings and interviewing pupils. The university researchers used teachers' and pupils' interpretations of the data to illuminate and deepen their analysis. In the third year, twelve further schools adopted and customised the models and strategies developed by the four initial schools, demonstrating their robustness and transferability.

### **What are the implications?**

The study showed the value of:

- encouraging pupils to make creative choices about how they learn a particular topic and what tools they want to use. Doing this can foster a greater sense of autonomy and responsibility for learning amongst the pupils which enhances their motivation and engagement
- asking pupils to work collaboratively on joint ICT led presentation projects for helping pupils take control of their learning as well as acquiring curriculum content
- finding out which pupils already have good ICT skills or knowledge of particular software packages because teachers can ask such pupils to train their peers (and in some cases the teacher too) to help others in the class learn new ICT techniques.

### **What do the case studies illustrate?**

The case studies show how:

- pupils felt having the freedom to use computers when they felt it was appropriate helped them with their learning
- students felt using the internet impacted on learning
- students were creative and innovative peer teachers when they were asked to teach each other
- students set about making films for learning and what they and their teachers felt they gained from the process.

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## Study

### **What kind of learning did the PELRS project focus on?**

Finding effective ways of preparing pupils for high stakes tests and examinations is topical in the English education system and a subject of much debate. The researchers were keen to find an alternative to the kind of

low-level memory work which is sometimes seen as effective. Instead, the PELRS project focused on 'transformative' learning whilst at the same time meeting the national curriculum attainment targets.

By 'transformative' learning, the researchers meant students:

- learning creatively - contributing, experimenting, solving problems
- learning as active citizens - acting autonomously, taking responsibility for their own learning
- engaging intellectually with powerful ideas, using thinking skills, grappling with ideas/concepts
- reflecting on and evaluating their own learning (metacognitive strategies).

We explore how teachers brought about this change of focus and show what transformative learning looked like in practice in the following sections.

### **How did the way teachers organised learning change?**

Before undertaking the PELRS work many of the teachers at the four schools involved planned to use ICT and e-learning resources in rather strict ways within their lessons. Often they had a very finite and restrictive ICT-based task in mind for the whole group. In contrast, the PELRS project encouraged teachers to plan learning events where students were given much greater degrees of freedom and choice about which ICT resources to use and how they should be used. In this way, PELRS gave students spaces for beginning to take some responsibility for their own learning.

Readers may like to read the case study that shows how a school encouraged pupils to choose which software they wanted to use for a task and how the pupils welcomed the opportunity it gave them to learn independently.

Teachers in the PELRS study started with a plenary session in which they outlined the curriculum focus and learning goals (normally taken from the national curriculum). The teacher then invited the pupils to suggest how they would like to work towards their goal. In particular, they could decide on their learning activities and choose resources to help them, including books, e-learning materials, and ICT tools such as the Internet, CD-ROMs, digital cameras, interactive whiteboards and laptop computers. Often, students drew on both ICT and traditional resources from a variety of different locations (classroom, library, specialist ICT suite, home and online).

Frequently, after the negotiated plenary sessions at the beginning of the learning events, the students organised themselves into groups so that they could work together to find things out and create a finished product. It fitted the PELRS emphasis on co-learning and enabled students to give each other mutual support. Usually, each group took responsibility for researching one particular strand of the topic and presenting it to the whole class in the final stages of the learning event.

Teachers planned PELRS work to take place over several lessons or during an extended period when the normal timetable had been suspended. The work entailed moving away from the usual pattern of teaching lessons as discrete blocks in which students were presented with the learning outcomes at the beginning and reviewed what they had learned at the end.

### **How did the way ICT was used in classrooms change?**

One of the main aims of PELRS was to re-direct computer use from specialist ICT lessons focused on skills acquisition, to enhance subject learning within the national curriculum. The research partnership developed four themed pedagogic strategies: pupils as teachers, pupils as media producers, pupil voice and learning online. With all four strategies, the aim was to change the traditional roles of teachers and learners - from teacher-led to student-led - through emphasising co-learning between them. In all four strategies, the focus was on transforming pupils' learning experiences, so that they became as creative, active, engaged and metacognitive (selecting thinking strategies deliberately to plan, monitor, and evaluate their own learning) as

possible.

### *Pupils as teachers*

With this strategy, pupils took on the role of teachers - they researched a topic (by searching the web and books etc) then taught it to their peers. For example, a Year 6 class was learning about the life cycle of plants and concepts such as interdependence, reproduction and habitat. The teacher gave groups of four different elements to research then teach to the rest of the group. The pupils reflected on different teaching strategies and media. Although ICT tools were popular, many groups also used more traditional technologies when preparing work. One group, for example, used the interactive whiteboard to deliver a short PowerPoint presentation. They then used a paper resource they had designed which had detachable parts of a plant. They invited other pupils to pin the parts in the correct place on the diagram.

### *Pupils as media producers*

With this strategy, pupils used e-learning resources to create their own media - digital video, still images, music or animations - linked to specific parts of the curriculum. For example, the German teacher at one school had found that students were often reluctant to talk in class in the target language. She decided to ask students to make a short film about their school in German. The project demonstrated to the students the importance of speaking in the target language. The fact that the film was to be viewed by others motivated the pupils to work hard and do as good a job as they could. As they filmed, the language teacher helped them to extend their script and add new scenes. The teacher's spontaneous questioning about new vocabulary showed the pupils that learning more German was beneficial and could help them make better films.

### *Pupil voice*

This strategy allowed pupils to discuss and recommend the ways in which they wished to be taught using ICT in school. For example, pupils at a secondary special school for pupils with moderate learning difficulties indicated that they would like to have some time for structured work on computers in each lesson. The teachers found out the kinds of activities which the pupils enjoyed and which benefited their learning and added these to their lesson design. They found some pupils had particular talents, for instance in using computer animation and image manipulation.

### *Learning online*

This strategy put learning and collaborating online in the foreground. For example, a class of Key Stage 2 pupils were formed into pairs and given access to the school's CD RfT facilities on planets and the solar system and access to the Internet. During the plenary session at the start of this learning event, the teacher and pupils discussed the relative merits of sources of information and how the pupils could navigate between the various resources available to them. Many pupils found material on the solar system which challenged their thinking about these topics and allowed them to engage with powerful ideas. For instance, one group of pupils wrestled with a statistic they had found about the amount of fuel needed to keep the sun burning (about thirteen petrol tankers per second).

## **How did PELRS teachers encourage student ownership over their learning?**

The PELRS approach meant that teachers structured students' learning through:

- giving the choice of a wide range of possible resources, and
- planning the task so that it encouraged creativity and diversity of responses.

The effect was to shift the ownership of knowledge to the students.

For example, in a primary school, a whole day was devoted to an exploratory project on Victorian people. The teachers provided names of people, chosen to represent a diverse and interesting cross-section of Victorian

life and they gave the pupils a list of things to find out about them. The pupils had access to the Internet as well as all the other ICT and traditional resources in the room for a day. They were given freedom to report back to the whole class in any way they liked. The teachers encouraged the pupils to think creatively about how they could provide evidence of meeting the learning outcomes and there was a conscious move away from a homogenous approach to ICT resource selection which could result in all pupils in a class producing identical or near identical products. Giving pupils choices led to greater diversity of learning between small groups and enabled more productive knowledge building when the groups presented their work to each other.

Practitioners may like to read the case study that explores students' views on how they used the Internet to help them learn.

In another school, the teacher used the 'pupils as teachers strategy' as a means of encouraging pupils to learn scientific concepts about the reproduction of plants. Pupils used the Internet as well as traditional resources to collect information. Some groups decided to make PowerPoint presentations to teach other pupils what they had learnt. But not all groups wanted to use PowerPoint. Some developed paper-based resources such as informational posters and one group produced a role play which was captured on digital video. This more active role as knowledge producers raised the level of motivation and also the intellectual engagement. When the teacher checked for knowledge retention several months later, the children were able to recall the concepts and the correct scientific terminology and use them with confidence.

Practitioners may like to read the case study that gives another example of peer teaching.

### **How did the PELRS way of working affect the students?**

The open-ended project briefs gave the students scope to display their own creativity and allowed them to choose their own methods of working. This increased their motivation and active engagement in learning, and led to different patterns of talk in the classroom.

#### *Increased motivation and engagement: less time managing behaviour*

Video data revealed that students were highly motivated by the new style of working. Student researchers reviewing the videos commented on the students' increased engagement with work with surprise. For example, a student commented: 'Look at John, he's really working, that's amazing, he usually spends most of the time messing about'. The teachers noticed how with the increased levels of motivation and engagement, they were spending less time than usual managing their students' behaviour.

#### *Changes in patterns of talk*

Videos showed examples of students approaching teachers and asking questions, for example about information they had found on the Internet. Teachers viewing the videos commented how they felt such student-initiated speech exchanges had been rarer before the project. At the same time, teachers noticed that their own talk seemed to have moved almost completely away from administrative and behavioural matters (ie. instructions and reprimands) and was more focused on the curriculum topic in question.

### **How else did the students benefit from the PELRS approach?**

The research demonstrated how the PELRS approach helped the students learn to take responsibility for their learning through co-learning and self-evaluation.

#### *Learning from each other*

In one primary school, in an area of social deprivation, the pupils' engagement with the task and success in learning were transformed by the process of finding information and preparing to teach their peers. Yet their actual presentations to the whole class were disrupted by the inattention of their peers. All the groups were

keen to give their own presentations, but were so used to paying attention only to the teacher that they switched off their attention when the teacher stood behind them at the back of the room.

In a second iteration of this learning event with another class, the teacher made the shift in the pupils' role more explicit, talking to them in advance about what would happen during the presentations and how she and they together would learn from the other pupils and the importance of paying attention to each other after they had worked so hard. With this more careful preparation for the role shift, the second class paid good attention to each others' presentations. It also led to the pupils thinking more carefully about their role as teachers and the need to hold their peers' attention.

### *Learning how to learn*

During the PELRS project, pupils became used to watching themselves engaging in classroom activities and this led to spontaneous comments on themselves and others, both as learners and as presenters. One group of nine pupils who made a digital video about their work for presentation to a GTC conference took a large number of 'takes' of each of the planned sequences because they were concerned to produce the highest possible quality of presentation. The editing work was done by one of the pupils in the group with minimal intervention from his teacher who was confident this pupil could produce a polished end product suitable to be shown to an external audience. To the great amusement of the conference audience when the video was shown, he added at the end a compilation of the 'out takes' which served to illustrate the group's process of self-evaluation as well as expressing their desire to produce something a bit different and more fun than a straight presentation.

Practitioners may like to read the case study about how other students made films for learning, and how they gained from the process.

### **Did teachers' lack of expertise with ICT act as a barrier to change?**

Teachers found that the change from a more directive, teacher-led role freed them up from having to demonstrate that they knew more than their pupils. This was particularly helpful to those teachers who felt they lacked technical expertise because:

it meant that teachers did not need to feel anxious about any lack of expertise with ICT on their own part. Rather, they could celebrate pupils' ICT skills and accept and value their varying levels of expertise it opened up the classroom to knowledge and information which the teacher had not pre-selected.

For example, a media studies teacher taking a year 10 group was keen to use computer design software for a marketing project, but found the software complicated. Talking to the class, she discovered that several students knew the software, and she decided to let them peer-train the other students, and herself. The classroom dynamics totally altered, with knowledge distributed across the learners. Whereas in previous years students had used paper-based tools to design their advertisements for a new product, this time, the students chose to work in the computer suite using a graphics package which enabled them to produce more 'professional' quality images and logos.

In another school, a group of primary pupils were expected to search the Internet for information about germination and the growth of plants. When they found information about plants that live in arid, sandy areas of the world for example, one group called the teacher over to discuss what they had discovered. The researchers commented how pupils' new role as selectors of knowledge seemed to give them a reason to initiate a discussion with the teacher. Working in this way also seemed to change the teacher's role to co-learner, especially where the teacher had previously known almost nothing about this kind of plant, shifting the role to knowledgeable co-learner. Encouraging the pupils to take pride in their discoveries and share them, both with their teachers and their peers, helped to create new understanding of the nature of knowledge acquisition, creation and use in the classroom.

### **What prevented ICT from being used in ways that transformed learning?**

The PELRS project revealed a number of barriers which prevented ICT from being used in ways that transformed learning:

- organisation of the school day into short time-frames - this made it difficult to give pupils control over ICT resources and allow them to use the exploratory power of the Internet. It was particularly difficult in secondary schools where the constant movement of students between rooms affected access to ICT equipment. All innovative work in the secondary schools and much of the innovative work in primary schools took place in special 'off-timetable' learning events
- rigid, formulaic lesson planning - where all resources, objectives and outcomes are predicted in advance and controlled by the teacher
- highly restricted access to the Internet - during the first two years of the project, access to the Internet was often far from ideal. Aggressive Internet filters sometimes made it impossible for pupils to use the Internet to access anything other than sites pre-determined by the school's technical experts. By the third year of the project, most schools had more sophisticated filtering systems that allowed more sensitive discrimination between sites so this major barrier was reduced
- the need for expert help - despite teachers' growing technical competence, the new style of working threw up problems which could only be overcome with expert help. For example, multiple groups working with still or video images require access to editing software and the necessary network resources to move this data around. Many teachers reported they needed more help in solving these particular issues.

### **Why did the researchers seek to bring about changes in teaching and learning with ICT?**

The researchers designed their project in response to research that had found that despite high levels of government spending on ICT in education, the impact of ICT on learning, in terms of enhanced national test scores and GCSE results, was minimal.

The ImpaCT2 evaluation of the UK National Grid for learning (NGfL) programme (see further reading), which was co-directed by the lead PELRS researcher, had revealed some possible reasons why ICT had had such a minimal impact:

- schools viewed ICT as a specialist subject rather than a new tool to support learning across the curriculum, which meant that students hardly ever used a computer in English, maths and science lessons. The limited effect on national test scores was therefore hardly surprising
- there was an enormous difference in the way that children used ICT at school and at home. At school, pupils were expected to follow instructions in ICT lessons (often in worksheet form) in order to acquire skills in using office software, whilst at home, they multi-tasked across a range of ICT, including Internet browsers, messaging services, building personal websites and downloading music.

### **How might teachers start to develop the PELRS way of working in their own schools?**

The project teachers' starting point was a generic pedagogic framework (GPF) diagram developed by the researchers in discussion with them; to see the diagram, see the Pedagogic Frameworks page on the PELRS website (Further reading). The research found that teachers felt it was a valuable starting point for discussion because it 'opened up a space for reflecting on their practice'. To help stimulate discussion amongst other teachers, we briefly explain the key elements here.



The learning focus is at the centre of the diagram. It has as its goal both the curriculum selected by the teacher (drawn from the National Curriculum) and the PELRS 'transformative learning outcomes' of creativity, active citizenship (making choices / taking responsibility for one's own learning), cognitive engagement and metacognition.

The teaching and learning process is represented in the diagram as a three-way interaction of pupils and teachers and ICT. The pupils' role in planning how their learning would take place is given a central position, but within the learning focus framed by teachers and pupils. Roles of teachers and pupils are negotiated with the implication that these roles are interchangeable or shared, and that co-learning rather than individualised learning takes place. Both pupils and teachers are placed in a social rather than an isolated environment, with the family and peers interacting with pupils and other adults influencing learning. This resonates with Vygotsky's work. To find out more about Vygotsky's theory, you may like to look at our earlier RfT Social interaction as a means of constructing learning.

Learning with ICT is depicted within a larger frame that incorporates the home and virtual environments as well as the school. ICT is seen as a set of mediating tools over which pupils can exercise choice, and through which they can learn through play, and experience flow (becoming absorbed and 'losing themselves' in the activity).

Each of the four themed strategies follows the same generic framework, but contain more specific suggestions as guidance for planning a learning event within the theme. The PELRS diagrammatic representation of pedagogy aims to make the process of change explicit to teachers and pupils by inviting change to their traditional roles, emphasising co-learning between them and the negotiation of their roles.

Practitioners who are interested in finding out more about the framework underpinning PELRS learning events, may like to explore the interactive version available on the PELRS website (see further reading).

### **How was the research designed?**

Initially, the research and development team worked with four schools (two primary and two secondary) in Manchester and Bolton, selected for their commitment to innovative uses of ICT and located in catchment areas with socio-economic backgrounds varying from impoverished to average. (All also had slightly better than average levels of ICT equipment for English schools at the time). The project focused on developing, implementing and evaluating innovative pedagogies with ICT whilst teaching curriculum subjects, rather than the discrete teaching of ICT skills.

The research and development team worked in partnership with the teacher-researchers and pupil-researchers to develop examples of successful, innovative changes to teaching and learning practices. The teachers planned the learning events, participated in the analysis and interpretation of data, and presented their work in public. A university-based researcher worked alongside the teachers and pupils, making video recordings and interviewing pupils. Frequently, he talked to the pupils while filming them to get their explanations of what they were doing now, what had led up to it and how they were planning to go on.

At any one time, at least four pupil-researchers (a mix of gender and ethnicity chosen for their ICT expertise) in each of the four schools worked with the university researchers, commenting on current usage of ICT in the school, suggesting new strategies for its use drawn from their experience at home, and participating in analysis of video data from their classroom. They were often able to uncover misinterpretations of data and explain puzzles, such as why they did not tell the teacher that they found a particular piece of maths software boring. ('If we did we might not get to use the computers at all, and that would be worse').

Teacher-researchers also spent time with the university-based researchers observing the same selections from the video data as the pupils so that interpretations of teachers, pupils and university-based researchers could be compared to deepen and illuminate interpretation. Thus the process of change was conducted concurrently with research into new kinds of teaching and learning with ICT and the resulting impact on pupils' learning.

Case studies illustrating the resulting models of transformative teaching and learning with ICT are available on the project website. In the third year PELRS worked with twelve further schools who adopted and customised these models, and the PELRS strategies and GPF, demonstrating their robustness and transferability.

### **What are the implications for teachers and leaders?**

Teachers may like to consider the following implications in acting out the main messages of the study.

- When teachers encouraged pupils to make creative choices about how they learned a particular topic and what tools they wanted to use, they fostered a greater sense of autonomy and responsibility for learning which enhanced pupils' motivation and engagement. Could you find more opportunities for pupils to use ICT in ways that enable them to take on responsibility for learning?
- Working collaboratively on joint ICT led presentation projects was effective both in helping pupils to take control of their learning and in helping them to acquire curriculum content and retain it months later. Would your pupils benefit from working together on an ICT based presentation, then reflecting on what they learned from the process?
- Teachers found that a lack of technical expertise on their part need not prevent their pupils from making good use of ICT. Finding out which pupils had good ICT skills or knowledge of particular software packages helped because teachers could ask such pupils to train their peers as well as the teacher, enabling the class to learn new ICT techniques. Would encouraging your pupils to share their ICT expertise across the group enable you and your pupils to make greater and/or more effective use of technology?

Leaders might like to consider the following implications.

- The researchers worked with the teachers to develop successful, innovative changes to teaching and learning involving ICT. Would you find it helpful to encourage your colleagues to discuss how they currently use ICT, and brainstorm alternative ways that have the potential to enhance teaching and learning? Could you encourage them to try out their ideas or perhaps some of the PELRS strategies, then ask them to share their experiences of what was effective?
- PELRS activities place demands on a school infrastructure which are not normally made by traditional learning activities. For example, multiple groups working with still or video images require access to editing software and the necessary network resources to move this data around. Could you and your colleagues share ideas on ways of solving these practical challenges?
- If your pupils are involved in making digital videos and/or PowerPoint presentations etc as teaching tools for their peers, would you find it helpful to make them a starting point for conversations with parents about the teaching and learning that takes place in school and perhaps ways that parents might support their children's learning at home? Could you experiment with different ways of making these examples of pupils' work accessible to parents, such as showing them at parents' evenings, making them available on the school website or sending them home to parents on a CD?
- PELRS activities revealed some barriers which prevented ICT from being used to maximise the transformative potential of ICT. In particular: the organisation of the school day into short time-frames; and highly restricted access to the internet through security software. Could you explore the extent to which these barriers exist in your school (perhaps by administering a questionnaire to pupils)? Could you involve pupils in working with teachers to find ways of overcoming these barriers?

### **Filling in the gaps**

Gaps that are uncovered in a piece of research have a useful role in making sure that future research builds cumulatively on what is known. This is particularly important but also challenging in the field of use of ICT where the technology itself moves on very quickly and where changes to practice work at many levels and are hard to capture. But research also needs to inform practice, so practitioners' interpretations of the gaps and follow-up questions are crucial. We think four kinds of studies would usefully supplement the PELRS project findings:

- follow up studies across a bigger sample, and where there are comparison groups and a wider range of evidence
- longitudinal evaluations of the approach, comparing intervention and control groups in and between schools
- studies that explore the use and impact of ICT with and between different age groups
- comparison studies that explore the impact on pupil learning of different approaches to ICT use.

### **What is your experience?**

Do you have any evidence about initiatives aimed at promoting learning through ICT? We would be interested to hear about examples of effective initiatives that promote self-directed, creative learning, such as film making ventures which we could perhaps feature in our case study section.

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## Case studies

We have chosen four case studies to illustrate aspects of the research reported in the RfT summary. All four case studies were carried out by teachers and were independent of the main study. The first case study shows how giving pupils the freedom to choose when and if they wanted to use a computer for a particular task helped them to learn, and take responsibility for their learning. The second case study explores how using the Internet impacts on learning from the students' point of view. Case study three shows the effects of students teaching each other using laptops. The fourth case study is an example of how students made films to help them learn about specific science concepts, which their teachers then used as a resource for other students.

### Using laptops as a tool to support learning

We chose this case study because it is an example of how pupils were given the freedom to use computers when they felt it was appropriate to do so, and didn't use them when they felt they were not the best tool for the job. The study involved 23 Year 6 children at a primary school on Jersey. All the pupils had a laptop computer that gave them access to printers, file sharing, the Internet and email via a wireless network. In lessons, the pupils chose software (such as, Microsoft Word, Excel, Publisher, PowerPoint, Internet Explorer, Paint and Logo) to fit their task rather than the teacher creating a task to teach the software. ICT was rarely taught as a discrete subject, and educational programs that put the computer in the position of tutor were rarely used.

The teacher-researcher wanted to find out how the pupils felt the approach to ICT helped them with their learning. He carried out taped interviews with the pupils individually, in pairs and in focus groups of five or six, and observed the children working over one school year. Later, he systematically coded the transcribed data and put them into categories. He found that the children welcomed the opportunity the teaching approach gave them for being responsible for their own learning, through:

- helping them to organise their work for themselves
- giving them choice
- co-learning with their peers
- making them aware of how they made decisions.

#### **Organising work independently**

All the children commented on how leaving the choice of which software package to use on their laptops helped them to be independent, organised and produce better work. Pupils' comments included:

'I feel happy working independently on my laptop ... because working the laptop is more organised than having lots of pieces of paper all around you.'

'Well, computers take less time, because if you're writing, it takes you quite a while, and if you make a mistake you have to start all over again if you're using pen and on your laptop you can use one button and you can delete something.'

#### **Choice**

The children were observed working on their own confidently and with increasing expertise. Many children

linked independence with choice. Most children said they preferred to make their own decisions about their work on the laptop and such decisions promoted ownership:

'I think it is easier when you have less choice but it is nicer when you have more choice, but it is harder with more choice, so I don't really know! But your work seems better when you have more choice.'

### **Co-learning**

If they felt they needed help, the children would ask a classmate - they shared their expertise willingly - but they did not feel that doing this was a sign of lack of independence:

'It's better with other people because every one knows something different and if you tell each other you'll know even more.'

'I think we work independently with no trouble, if we are stuck we will ask each other but then again we don't need others that much.'

The children contrasted this kind of co-learning with simply working together at a computer. They remembered that when there had been fewer computers in school, two or more children would work together at a computer. The children commented on how they used to co-operate with each other rather than collaborate - they did not work together to solve a problem.

### **Being aware of how they made decisions**

Requiring the children to complete tasks that involved higher-order thinking skills (such as problem-solving with unfamiliar software) helped them to be aware of how they made decisions. Reflecting on their learning helped them cope with new tasks:

'I think in new programs we know what to do because either we have vaguely seen it somewhere else in our life, somebody on our table knows it or you can just explore and if you get it wrong, start again or press undo or back. Also we find skills that we have used before.'

The children welcomed the teaching approach because they saw it helped them to develop independence and ownership of their work and their learning:

'When you [teacher-researcher] tell us what to do it isn't really the same, like it would actually be you telling us how to do it and we would mostly learn nothing because we really didn't do it ourselves, it would be mostly you that did it because you told us what to do.'

The teacher-researcher concluded that the children's views supported the current shift in thinking from traditional teacher-centred instructional methods to pupil-centred classrooms. He also suggested that integrating ICT with problem solving activities helped realise the pupil-centred approach because the children took greater responsibility for their own learning.

### **Reference**

Doyle, D. (2004) Perspectives of One-to-One Laptop Access. National Teacher Research Panel summary available from:

[www.standards.dfes.gov.uk/ntrp/publications/](http://www.standards.dfes.gov.uk/ntrp/publications/)

## **Using the Internet for teaching and learning**

We chose this case study because it explores how using the Internet impacts on learning from the students' point of view. The study took place at a large 11-18 comprehensive school in Cambridge and involved over 200 students from years 8-10. The science, mathematics, geography and art departments planned a unit of work involving use of the Internet. The students were surveyed about the impact of using the Internet on

learning at the end of the unit. The students were generally positive about using the Internet in their lessons. They appreciated the value of using the Internet for developing independent learning skills and being able to work at their own pace.

### **What did the units of work involve?**

In art, students researched the styles of different artists so that they could identify with a particular style of painting and drawing. The students then worked on a storyboard depicting a particular event or activity using their chosen 'style'.

In chemistry, students researched the properties of the atmosphere of Venus so that they could decide on the best materials to build a spacecraft to fly to Venus. The students then experimented with the reaction of different metals to combinations of acids based on their research.

In geography, the students went on a virtual field trip to Antarctica and used satellite imagery, virtual walks, data and scientific reports to experience what life is like in a remote and cold part of the world. The students had to report on their experience and prepare a presentation to an audience as though they had experienced the visit in real life.

In mathematics, students explored the value of topic-based websites to support differentiated learning in mixed ability groups. Most of the sites used involved interactive materials and active diagrams.

### **The impact on learning**

All pupils expressed a strong liking for using the Internet in learning: 'I felt I wanted to learn more' ... 'It made me more interested in studying'. They were also able to articulate a qualitative difference to their usual learning experience:

'It is a different experience ... instead of being told, you have to find out the information.'

'I had to broaden my mind and use information I wouldn't have thought of including.'

'I took the info in instead of almost falling asleep.'

'Using the Internet is more interactive than normal learning.'

'I thought more laterally.'

Many of their comments referred to the motivational factor of Internet use:

'I find a computer more interesting than using books and I tend to work harder and faster.'

'When using ICT my motivation to learn increases.'

Some pupils discovered that they were more effective learners than they had realised: 'I was better than I thought at research', whilst others found less positive aspects: 'I found out I don't like looking for information'.

The students were surprised by the number of 'traditional' skills that they still needed:

'You still have to skim read.'

'You have to spell correctly or the search engine won't be able to find what you want.'

'You need to be able to take notes well.'

'You have to be good at reading the instructions that you get on the screen.'

Students saw the use of the Internet as reflecting an approach to learning which they felt to be relevant to their future lives:

'You take responsibility to find out what you need for your own project -- it's independent study.'

'I'll need to be able to do this when I go to university.'

'There's a more calm and mature working environment -- it's not like being at school.'

But they identified downsides too, mostly to do with time:

'Slow access and it can crash and then you have to begin again.'

'Too much to explore in one hour.'

'Run out of time after finding what you want.'

However the positives far outweighed the negatives, including:

'Being able to work at your own pace.'

'Having to use different skills.'

'I can develop computer literacy at the same time.'

### **Reference**

Wells, A. (1999) A case study of effective teaching with and through the Internet Netherhall/TTA project:  
[www.school-portal.co.uk/GroupHomepage.asp?GroupId=6478](http://www.school-portal.co.uk/GroupHomepage.asp?GroupId=6478)

## **Students as peer teachers**

We chose this case study because it is a cautionary tale of the effects of passing the responsibility for how they learn completely to the students. In this study, whilst the students' performance was enhanced in the long run, initially, their performance dipped.

In what was a quite radical experiment, a group of Year 8 students, each with a laptop, were expected to teach each other for two years. Each student was paired to a 'buddy' who had the same academic attainment and potential (the control group). The experiment showed that when left to their own devices, the students became creative and innovative peer teachers.

Over time, the teaching methods used by the class evolved from aping what they had experienced when being taught by an adult, to taking what really worked and gripping their classmates. Learning occurred naturally. For example, they learned the need for multiple sources through looking at Internet sites. They came to the conclusion themselves that they had to look at three or four sites on the Internet before they delivered their lesson, as if they only found one dodgy one and someone else in the class had already found a better site, they would be shown up in front of their friends.

Although in time, the students evolved academic and personal skills far beyond those of their peers, initially, it looked like their academic performance was dropping. The students performed worse on the SAT tests at the end of Year 9 than their peers - the deputy head had warned parents that this would happen. What seemed to be happening was that their true academic performance was showing through. However, when they later

came to take their GCSEs, the laptop students achieved higher grades than their buddies in all their GCSE subjects. The deputy head commented:

'When you first give children control over their own learning, it's scary because you realise that they can't do all those things you thought they could do. Everything has been broken up by teachers so much that it only looks like they understand. They're actually following menus, not really thinking it through'.

### **Reference**

Dan Buckley, Students as peer teachers:

[www.futurelab.org.uk/projects/teachers\\_as\\_innovators/stories\\_of\\_practice/students\\_as\\_peer\\_teachers](http://www.futurelab.org.uk/projects/teachers_as_innovators/stories_of_practice/students_as_peer_teachers)

## **Films for learning**

We chose this case study because it shows how students set about making films for learning and what they and their teachers felt they gained from the process.

Students at a specialist science college in Dorset worked in groups to make short educational films to explain key science topics, such as the Doppler effect, DNA and the Van de Graaf generator, on the premise that 'you can't make a film about something if you don't understand it'. Teachers also anticipated using the films in class to engage other students. They felt that it was often the case that they searched a 20 minute video for a 30 second clip that didn't really fit into the focus of the lesson, and that having a bank of made to measure clips would save time in both planning and lessons.

The project involved six teachers and six groups of students aged 13-18 years and took five days to complete.

### **What did the film-making process involve?**

First, the students were introduced to the film-making concept through making a 30-second film about a school chair. Having only one hour to complete the project, with all editing being done in the camera itself, helped to focus the students and helped them to see the limitations of what they could do.

The students were then introduced to six 'clients' - the teachers. The clients briefed the student teams with their problems, along the lines of, 'I need to teach X, but it is difficult/dangerous to demonstrate in class'. The students brainstormed on the subjects, researched them and interrogated their clients for more information, such as what aspect of learning needed to be indicated.

Next came storyboarding, along with shot lists. This part of the process was followed by a ten-day gap before the actual filming, to give the students time to arrange locations and props. After filming the teams edited their takes, adding music and voiceovers.

The films were made using the cheapest available equipment, such as Microsoft Movie Maker (free with all versions of XP) or iMovie (free on Mac). Movie maker handles smaller, lower quality files than iMovie on Mac which works with AVI files, but the quality of the smaller PC files was fine for the purpose of the films and also meant the students could take their work home with them more easily.

### **What techniques did the students use?**

To explain the Doppler effect, one group made a film in which a man-sized dummy with a pink balloon for a head and a horn embedded in his back was thrown from the top of a cliff. As he fell, the sound emitted from the horn changed pitch. This physical demonstration, was followed by an animation of what had just happened to explain the Doppler effect in more detail. A voice over explained that 'Sebastian' was walking along a dangerous cliff, but unfortunately, due to lack of eyes, he walked off the edge. The cartoon and film continued with the voiceover commenting: 'At this point we shall model Sebastian's screaming as sound waves emanating from a single point'.

Another group used gothic horror to explain the Van de Graaf generator (which demonstrates current). They

used no words. Instead they composed and made the music for the film themselves. A group, who made a film to explain DNA called '23 pieces', also made a documentary on the making of the film. It included explanations by the students of how the project had evolved, how they had created the special effects, the problems they had encountered, and how they had learned from them, and how much they had learned about DNA from making the film etc.

### **How did the students benefit from taking part in the project?**

The teachers observed how the students were in control of their learning. They had to learn the subject they were to communicate, collaborate with each other, work to a brief, work with adults, work safely and work within time constraints. They also had to satisfy their clients. The teachers felt that students of all abilities did well and noted how students with behavioural issues showed no such issues during the project. For example, although they had to wait for other people at times, they sat without fidgeting for ten minutes. In other circumstances they would have messed around. They learned to be part of a team.

Their teachers commented, for example:

'During the project I found with fascination that all students were sufficiently motivated to want to learn more about areas outside their experience. The student interested in music, for example, now regularly shoots and edits film as a vehicle for his composition and sequencing talents.'

'I found myself in awe of the way that the desire to learn quickly spread to other areas. I was also impressed by the way that their motivation became the driver behind overcoming shyness and to work to a deadline, which is always an issue.'

### **How did the teachers view the experience?**

The teachers were very positive about the film-making project - both the process and the products - as these comments show:

'It was simple to get the students enthused and churning out some great ideas. However it was difficult to focus the creative minds on one idea and to get them to stick with it to the end. If I did it all again I think I would have narrowed the aim of the film to allow the students to concentrate on a more attainable target in the time frame allocated. The students were very ambitious, but perhaps needed to have this kerbed more.'

'I enjoyed letting go and have the students take control of some matters. It was very refreshing to be in this position and very rewarding for both students and myself.'

'In a world in which videos are commonplace in the classroom, new and exiting life is injected by involving them in the making process. It "connects" them with the material.'

### **Reference**

'Films for learning', Mark Richardson, Thomas Hardy School, Dorset. Details at:  
[www.futurelab.org.uk/projects/teachers\\_as\\_innovators/stories\\_of\\_practice/films\\_for\\_learning](http://www.futurelab.org.uk/projects/teachers_as_innovators/stories_of_practice/films_for_learning)

The 'Doppler for dummies', '23 pieces' and 'Van De Graaf films can all be viewed at:  
[www.filmsforlearning.org/](http://www.filmsforlearning.org/)

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## Further reading

What else might I enjoy reading?

Somekh, B. & Saunders, L. (2007) Developing knowledge through intervention: meaning and definition of



'quality' in research into change. Research Papers in Education, 22 (2), pp. 183-197.

Pearson, M. & Somekh, B. (2006) Learning transformation with technology: a question of sociocultural contexts?

International Journal of Qualitative Studies in Education, 19 (4), pp. 519-539.

Somekh, B. (2007) Pedagogy and learning with ICT: Researching the Art of Innovation. London: Routledge.

Online information about the PELRS project and related research

The PELRS project website <http://www.pelrs.org.uk/>

ICT Testbed Evaluation case studies <http://www.evaluation.icctestbed.org.uk/research>

FutureLab: literature reviews

<http://www.futurelab.org.uk/resources/publications-reports-articles/literature-reviews>

Includes article on 'Informal learning with technology outside school'.

InterActive Education <http://www.interactiveeducation.ac.uk/index.htm>

See especially the links to 'What we found out' and 'Tools for transforming learning'.

ImpaCT2: Pupil learning and attainment

<http://partners.becta.org.uk/index.php?section=rh&rid=13606>

The impact of ICT on pupil learning and attainment.

The motivational effect of ICT on pupils

<http://www.dcsf.gov.uk/research/programmeofresearch/projectinformation.cfm?projectid=13757&resultspage=1>

Their space: Education for a digital generation <http://www.demos.co.uk/publications/theirspace>

Resources

Becta's self review framework <http://publications.becta.org.uk/display.cfm?resID=28629>

Films for learning <http://www.filmsforlearning.org/>

A resource that aims to inspire and help teachers and students to make their own teaching videos

GridClub

<http://www.gridclub.com/>

A portal with an extensive suite of resources and 'edutainment' games covering all areas of the National Curriculum.

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## Appraisal

### Robustness

The project aimed to develop ICT based pedagogies across the curriculum in Key Stages 2 and 3. It was part-sponsored by both the General Teaching Council (GTC) and the University of Cambridge Local Examination Syndicate (UCLES).

The project involved a partnership of teachers, school leaders and researchers from the Centre for ICT, Pedagogy and Learning at Manchester Metropolitan University (MMU) with the aim of building a knowledge base in the schools involved about the implications of ICT for teaching and learning, curriculum and assessment.

The university researchers worked with the following schools:

- Broughton Junior School, Lincolnshire
- Charles Kingsley's Church of England Primary School, Hampshire
- Eckington School
- Emley First School, Huddersfield
- George Spencer School and Technology College
- Holme Valley Primary School
- Kirby Hill Church of England Primary School
- Kirkburton C E (C) First School, Huddersfield
- Kirmington C of E Primary School
- Medlock Valley High School
- Primrose Hill Primary School
- Sandilands Junior School
- Seymour Road Primary School
- St Bernadette's Catholic Primary School
- St Nortbert's RC Primary School
- Westhoughton High School Specialist Technology College

The research and development work complements new developments in ICT-based education in England including: increased government investment in ICT infrastructure for education and the development of Curriculum Online, and a substantial increase in web-based materials, DVDs, CD-ROMs and web authoring tools including digital cameras and camcorders available to schools (here called E-Learning Resources, ELRs). It also supports the DfES's (now the DCSF - Department for Children, Schools and Families) policy of encouraging schools to experiment with new approaches to curriculum and learning (DfES 2002); and new approaches to assessment which recognise and value new kinds of learning alongside more traditional achievements.

The research and development team initially worked with four case study schools using an action research approach. A university-based researcher worked with teachers and students, making video recordings, analysing the recordings with teachers and students and interviewing students. The project was expanded to take in 12 new schools at the end of two years. This provided the researchers with the opportunity to test the usability of the pedagogic strategies and planning frameworks that had been developed in the earlier phase of the project in a slightly wider range of contexts.

The PELRS approach was structured so that students and teachers worked cooperatively to build students' learning rather than the teacher acting as a provider of information to students. During the process the teachers developed professionally and generated research knowledge to inform future practice. The researchers found that the approach gave students the opportunity to be creative and to take responsibility for their own learning.

## **Relevance**

The project addressed the needs for both teachers' professional development with ICT and the generation of evidence to inform practice through an 'involvement-in-research approach', rather than through skills-based training such as that supported by the New Opportunity Fund. The study outcomes provide information about:

- how teachers changed the way they organised teaching and use of ICT
- steps teachers took to encourage student ownership of learning, and
- how teachers' confidence in using ICT improved.

There was evidence that the explicit attention PELRS gave to re-defining roles within the classroom freed

teachers from the pressure to show they have total expertise on every aspect of a technology. This allowed expertise to be created among students within the classroom and shared across groups,. This contrasts with traditional models wherein all the technical skills have come through the agency of the teacher.

### **Applicability**

The study contained a number of messages for practitioners who are trying to use ICT more effectively for teaching and learning and who wish to avoid the tendency for ICT to become associated more with skills than with learning curriculum content. Through the planning of activities using ICT which were open-ended, and where real creative choices are placed in the hands of the pupil, PELRS showed that teachers and pupils can share the objective of learning and plan the use of technology to achieve that objective. Opportunities for peer coaching and the sharing of expertise among pupils were enhanced during the PELRS project (when measured against lessons where access to ICT is controlled in a traditional way), and teachers reported this as being effective in helping all pupils achieve more. In particular, the 'pupils as teachers' strategy was found to be highly motivating for pupils.

### **Writing**

The PELRS project was reported in a number of research papers and books. The research is sign-posted with helpful headings, but the overall tone is rather academic and teachers might find the theory described in the authors' literature difficult to follow.

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