

From M-learning pilot activity to embedded practice vbnm

From M-learning pilot activity to embedded practice:
using formative evaluation to inform scaled-up implementation

Terry Russell

Centre for Research in Primary Science and Technology, University of Liverpool

David Whyley

Wolverhampton City Council

Abstract

This paper describes the implementation of a mobile learning strategy centred on the use of PDAs by learners in the 9-14 age range having 24/7 access. It is presented from two perspectives. The first is from the practical perspective of project management – that is, the practicalities of engaging and sustaining schools, their management, teachers, parents and pupils in mobile learning. The second is a more formal description of the processes and interactions that describe mobile learning embedded in schools and beyond. The formal model draws together the important variables that impact on mobile learning as it may be implemented within a school's pedagogical vision. From the school-centred account, we move to a description of the wider engagement of schools within a Local Authority as exemplified by Wolverhampton's 'Learning2Go' project. The considerations to be taken into account in engaging, managing and sustaining mobile learning practices in a cohort of schools in which over one thousand handheld devices are in use are discussed. Practical factors to be taken into account in this wider roll-out include national political imperatives as well as large-scale training, technical support and ensuring the sustainability of the model. The paper moves to consider the educational rewards and outcomes of these efforts. The education system in England has an in-built monitoring system in the form of end of key stage tests. Some of the challenges and opportunities of attempting to measure the outcomes of innovative practices using traditional pencil and paper tests are discussed. The particular support that mobile learning offers to a pedagogy in which formative assessment plays a key role is discussed.

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Introduction

The Learning2Go project is centred in Wolverhampton, an urban conurbation in the industrial heartland of England, characterized by areas of severe deprivation, an ethnically diverse population and 'digital divide'. The paper discusses how such an initiative has managed to thrive and attract a growing interest and considers against what criteria valid and reliable evaluation evidence might be collected. Important considerations include the diverse range of stakeholders and the particular interests of different stakeholding groups.

'Mobile learning' is a term used to define the type of learning that takes place when the learner has some kind of mobile handheld computer such as a PDA, Smartphone, tablet PC, games console or other portable device and is able to make use of the appliance, its connectivity, tools and content to learn at a time and place of their own choosing. Some of the recent trends in this area are described by van der Merwe and Brown (2005). The 'Learning2Go' project uses mobile handheld computers to engage learners by delivering multimedia content, Internet and authoring tools. It delivers 24/7 personalised learning and gives learners the choice to learn when they want, how they want and where they want. Learning2Go involves teachers, learners and their families. It also has involved collaboration between Wolverhampton Local Authority, prominent hardware and software manufacturers, academics and government agencies that are keen to research the impact and development of mobile learning.

The following features characterise the project ethos:

- The learner has the device 24/7
- The teacher is key - if the teacher has not planned for using the device or is not enthusiastic about the possibilities, then it will not be used.
- Learners can and will become more expert than adults.
- Complete wireless coverage is provided in the schools
- Content and applications are of equal importance.
- Learning is assumed to take place at different rates and at different times.
- Collaboration and peer support are encouraged.
- Learners share the technology with their families.
- Learning through play – ‘plearning’ as one child dubbed it – is valued.

Heeding the ‘learner voice’ has been a key consideration and the Learning2Go project embodies a core belief that learners should have the choice and self-confidence to learn when, how and where they want. The project promotes a personalised learning experience in which each learner takes responsibility for managing their own mobile handheld computer and has a share in the shaping of their own learning. Learners have had a major input into the ethos, direction and development of the project.

Some of the educational impacts that have struck experienced observers of the kind of innovation introduced by Learning2Go include:

- Changes in the quality and breadth of learning and access to information, its ownership and learners’ motivation.
- Changes in the nature of the relationship between learner and teacher.

- Changes in the relationship between parents and teacher, home and school.
- Innovative opportunities for integrating assessment into teaching and learning that can impact profoundly on pedagogy.

For the most part, this paper offers descriptive and ethnographic evidence for these claims as a pre-cursor to systematic research. To describe the nature of the innovation more fully, it is necessary to consider not just teachers and learners but also school systems as well as links to home and learners' life needs. It would be very difficult for a teacher within a school to operate mobile learning in isolation. School senior managers and governors will formulate a plan based on their vision of what they wish to achieve in terms of embedding ICT. To help them review their needs, various supporting documents have been put in place in the UK. For example, Becta has developed a Self Review Framework (Becta 2006a). There is also a website <http://www.matrix.ncsl.org.uk> that offers guidance, the 'matrix' being an online tool developed by the National College for School Leadership and Becta that facilitates self-evaluation and planning. The matrix can be used by a school to review its current position against a set of statements. As the statements are completed, an action plan is generated.

The reality of translating a school's vision into practical operations requires funding and may be constrained by previous investment, the nature of school buildings, and so on. In the context of introducing mobile learning, it may be necessary to accept that 'legacy equipment' may include suites of desktop computers. Involving teachers in decision-making around matters that will impinge in fundamental ways on their classroom practices requires the allocation of time and resources. It would be usual for delegated responsibility for translating school policy into action to be mediated by ICT co-ordinators. These specialist teachers would be likely to

have responsibility for identifying teachers' training needs, perhaps providing some of that training themselves as well as supporting staff development more widely by accessing available resources. With these elements in place, we may expect to see 'embedded' ICT-mediated learning in classrooms. Such an embedded scenario is illustrated diagrammatically in Figure 1.

[INSERT FIGURE 1 ABOUT HERE]

ICT practices are defined as being embedded in classrooms when they take second place to the teacher's pedagogical concerns about what is being taught and the manner of its teaching, (see for example, Russell and McGuigan, 2006) and when pupils select digital resources from available tools, as and when they decide they need them to support their learning. That is, ICT is not an end in itself but is subsumed to the content and processes of teaching and learning as a set of enabling resources. Of course, when exposed to such an environment, pupils' ICT skills invariably advance at pace – sometimes at an astonishingly fast pace, but that outcome is incidental added value to the primary teaching objectives. Two classroom scenarios can succinctly illustrate what we have in mind.

Illustration 1. A secondary science laboratory proceeds with an investigation of the neutralisation of an acid solution. The teacher has the lesson objective summarised on the IWB and pupils use their PDAs to video-record the colour change in the indicator. They also record their results using Pocket Word or Excel. Using 'Dot Pocket' to link her PDA to the IWB, the teacher locates an Internet site that offers pupils brief revision exercises, making the point that they may access such a site at any time during the day using wireless access.

Illustration 2. A primary teacher conducts an indoor hockey game. Those pupils not directly involved in a game at any time engage in literacy activities – commentating on the game

(using observation and verbal analysis). Other language genres are used – journalistic reporting and oral interviews which are also video-recorded or which use digital still images for illustration. Excel is used to record scores and to construct league tables of results. The Physical Education aspect – apart from the direct experience of the game and the deployment of skills – will be analysed by children later, using video-analysis of techniques of positioning, stopping, turning and hitting the puck.

Depending on the school's choice of hardware, software and provision of access to a wireless network, great leaps forward can be offered to pupils in terms of their access to mobile learning opportunities. With 24/7 access, the bridging of the digital divide unleashes a radical innovation in allowing pupils ownership and control of the technology. Whereas such bridging might have been anticipated as opening access from centre to periphery (or put another way, from the establishment to the masses) what we actually observe is an equal or greater flow of user knowledge and expertise from the periphery to the centre. Pupils' knowledge and control of digital resources in their informal home and cultural lives floods back into the formal educational system. What is apparent from the Learning2Go experience is that learners' mastery of the digital resource is motivated by their own 'life needs'. That is, the interest in communicating with friends, accessing music, computer games, photographing and video-recording family and peers and other such pursuits drive the achievement of proficiency at a far greater rate than schools would expect in other contexts, for example, acquisition of ICT skills in a computer laboratory. A great deal of peer-to-peer mentoring is in evidence as well as software sharing, mutual technical support and problem solving. Not least, for many families, a child's PDA ownership initiates a family interest in ICT - a burgeoning curiosity that is supported and nurtured by school-based activities of various kinds in Wolverhampton.

The addition of some form of school Information Management System (IMS) extends possibilities still further, as illustrated in Figure 2. With the potential inclusion of a 'learning platform' and virtual space for e-portfolios, it is possible to arrive at a cycle in which performance data can be collected at the system level, to be used to inform refinement of the system itself. For example, the impact on learners' achievements of various teacher interventions can be monitored through the learning platform and this information used to inform elaboration of the school's vision of what is effective within its own particular context.

[INSERT FIGURE 2 ABOUT HERE]

The developments described above are of enormous interest and excitement to educators who have seen pupils' control of and engagement with the technology at first hand. It is as though what ICT has promised to education for so many years is at last becoming a reality, with the opportunity for pedagogical objectives to subsume the technical wherewithal, rather than the converse. Perhaps because technology has promised so much for so long, the current situation is that mobile learning must next prove its efficacy with hard evidence rather than by reference to the enthusiasm and commitment of its evangelists.

It is possible to identify three phases in the development of schools' and teachers' implementation of the practices described, as tentative ideas that could be the subject of a more systematic formative evaluation.

1. In the first phase, matters are at their most experimental and the fundamental question is likely to be, 'Can we get this potentially useful technology to work in schools and classrooms?' The introduction of ICT in this first phase is likely to be in parallel with

pedagogical concerns, with attempts made to complement one with the other. Proceedings may be on the basis of trial and error and serendipity – the final outcomes will not be known.

2. The second phase can proceed with greater certainty because the characteristics of the digital resources are of known quality and reliability. At this point, pedagogical concerns can determine the quality of teaching and learning events in the classroom. The ICT is subsumed to, and is in the service of, the teacher's educational agenda. Some teachers describe the ICT as becoming 'transparent' at this point, meaning that classroom interactions are foregrounded. It may well be the case that the efficacy of learning outcomes is an unknown in this phase, because it is only when control of the digital resource has been mastered that its impact on learning may be judged.

3. In the third phase, the scattergun approach of the phase 2 'We know it works, so let's see what we can do with it.' can be displaced by a better informed and more closely targeted set of strategies. ICT will be used *selectively* and more *purposefully* to target the differentiated needs of pupils.

[INSERT FIGURE 3 ABOUT HERE]

Currently, in Wolverhampton, some teachers have aspects of the third phase in their repertoire of practices. The present need is to carry out an audit of these exemplary practices, in order to describe them fully and disseminate them more widely as an inspirational resource for colleagues to adopt and develop to their own needs.

One further point to make about these three phases is that, when new technology is introduced – for example, plug-in data loggers, GPS or wireless linkage to the IWB, it may be

that teachers drop back to the first phase to learn the possibilities and idiosyncrasies of the new resource before taking control of it and finally, using it in a more precisely targeted manner.

Issues to be addressed in scaling up the Learning2Go project

What we have discussed up to this point can be used to describe developments within a single school. The scaling up and consolidation of the programme in a Local Authority such as Wolverhampton must take into account the needs of a cohort of schools, and several issues need to be addressed:

- i. establishing consonance with the wider governmental strategy and educational vision;
- ii. the design and implementation of a sustainable funding model;
- iii. training and support for teachers;
- iv. technical support for the system and its users;
- v. the provision of personalised learning space.

Educational vision and consultation processes with schools

As with all innovation projects, it is important to have a well defined shared vision with school leaders, and this will influence the scaling up of the project. As the aims of the project are firmly embedded in the educational, social and emotional needs of learners rather than in a piece of technology, it is easier to share the perceived benefits and ethos. The Learning2Go project has at its heart the ambitions of the Government's e-strategy and the five goals of the Children's Act 2004, (www.everychildmatters.gov.uk).

- Being healthy
- Staying Safe
- Enjoying and achieving
- Making a positive contribution
- Achieve economic well being.

With this ethos at its core the Learning2Go project has been seen by the early adopters as a means of delivering many of the current educational challenges for their school and school community. Enabling the headteachers to visit and meet with lead teachers and their learners has been an essential ingredient in terms of disseminating the project beyond the initial phase 1 schools. Phase 3 schools include a larger proportion of secondary schools and this has been a direct response to a realisation that the learners entering Year 7 (induction year for secondary pupils in England) would have substantial technological ability which should be built upon. A further catalyst to encourage schools that have not yet come on board has been the publication of an external formative evaluation of the project (Perry, 2005) and the recognition that a total package including training, support, technical assistance, funding models and content and software development has become available. Those schools that have yet to join the project are waiting to review outcomes and time their possible involvement to coincide with their own in-school priorities. Some schools see the use of handhelds as part of a continuum of steps gradually embedding technology into teaching and learning, moving from i), a suite of desktop computers to ii) a complementary set of wireless-enabled laptops and iii) a wired main network supplemented by wireless laptops and handheld devices.

Funding and sustainability model

Learning2Go is innovative in the way it uses technology, but also in the way that it arranges funding. In order to enable learners to have their own personal handheld computer, the model used is one of joint funding between schools and parents. The system is familiar to schools in that it works in a similar way to the arrangement they use for funding pupils' out-of-school educational visits. Parents make a contribution while the school will subsidise with money from its own budget resources, in order to make the whole package financially attractive and accessible to all pupils.

Initially, Learning2Go was funded totally by the Wolverhampton Local Authority. Parents were asked at the end of the project's pilot phase whether they would be prepared to make a contribution to their children owning their device. In the light of positive feedback, a phase 2 model was put forward which asked parents for a contribution. An indication of the scale of that contribution relative to many families' expenditure was to express it in terms of the equivalent of 'a pint of beer a week or a packet of cigarettes a fortnight'. Any shortfall in funding was then to be made good by the school, and supplemented by gift aid contributions from the E-Learning Foundation.

The current funding model is based on a two year cycle, jointly funded by the school and parents, the latter being invited to make one hundred payments over that period. The short product replacement cycle of mobile devices is a consideration, with PDAs being more akin to mobile telephones (which have an even shorter product replacement cycle of perhaps one year) than desktop computers. Insurance is included in the price of the device and is jointly funded, as

described above. In addition, digital content and a memory card are eligible for funding by the school using government-funded e-learning credits. Further added value is provided by the school in the shape of a wireless infrastructure.

There have been various interpretations of this model by schools – more variations on a theme than radical departures. The typical model adopted by primary schools has been to begin the project in Year 5 (with pupils of 9-10 years of age) and allow it to run for two years with learners taking devices into their sixth year of schooling. Forward-looking secondary schools have joint-funded devices in Year 6, taking the devices through the pupils' transfer to secondary education at Year 7, thereby creating an interesting model of continuity in transition. These methods of funding are exploratory innovations and, as such, are changing and developing continuously in the light of experience.

A key enabling partner in the funding is the E-Learning Foundation which is a registered charity, (<http://www.e-learningfoundation.com/>). The Foundation aims to reduce the 'digital divide' by working with schools, parents and others to ensure that all children have access to the learning resources that technology can make available, when and where they need them, both at home and at school, with equity of access a priority. As the Foundation is endorsed by the UK government, adoption of the scheme by local Wolverhampton Council members was a realistic proposition. The donations made by parents through their children's schools attract 'Gift Aid' as long as the scheme is equitable - charities registered with the Charity Commission may claim repayment of tax under this scheme provided the conditions for the Gift Aid tax relief are

satisfied. Schools are then eligible for grant support from the Foundation, which also bears the costs of administrating the scheme.

Technical issues

Involvement in a mobile learning project will place extra demands on the current level of technical support that an establishment requires. One of the main technical aspects that has to be dealt with is the wireless connectivity on the school's site. In order to get the maximum benefits from their handheld devices, learners need to be connected to a robust and reliable wireless LAN which connects to the high bandwidth schools broadband network. The Learning2Go project is currently using a system that enables more than 30 devices to be connected concurrently. This facility is becoming increasingly important as the project begins to use collaborative learning, voting and display systems which require that all class devices be simultaneously connected.

From the learner's perspective, technical support needs to be so good that the devices work dependably. An interesting and unexpected outcome has been the extent to which learners themselves have developed technical competence. In providing young learners with a sophisticated handheld computer 24/7, the Learning2Go project has facilitated their ICT capability in a way that traditional lessons in the ICT suite never could. The learners have had to acquire 21st century skills such as synchronising their data to their user area on the school's network, closing down running programmes to conserve battery, connecting to the Internet wirelessly, using bluetooth technology to beam files to their friends and making sure they come to school with their device's battery fully charged. Another key factor in the project's success has

been the ability to connect the devices to the interactive whiteboard and projector, both for teacher demonstrations and for learner presentations.

Training

Staff professional development is key to the success of any innovation in a learning establishment. The evidence suggests that teachers feel that they have a continuing need for continuing professional development in ICT (Becta, 2006b). Schools have to allow enough funds for Professional development with ICT projects. Part of the commitment to the Learning 2 Go project was an assurance by school leaders that staff would take advantage of the linked professional development package, which offers the following:

- each teacher received 3 x half days introductory training in the first half term;
- Session1 – Teacher receives personal device;
- Session2 – Teacher receives content;
- Session3 – Teacher receives planned activities and picks up learners devices;
- half day per half term training for rest of the year;
- Total to schools 8 x half days = 4 days total teacher replacement requirement.

In addition the following support was put into place building on previous success with embedding technology via a personalised training model called, 'Hands on Support':

- access to expert members of staff from phase 1 to support the project;
- construction of 'What works' Scenarios;

- modeling of the key features of an M-learning classroom;
- 'Little and often' training following the Wolverhampton 'Hands on Support' Model;
- routine day-to-day management of the devices.

In January 2006, an external evaluator, David Perry, observed the rapid adoption of the handheld devices in the majority of Learning2Go schools commenting:

“The outstanding development has been the pace at which the project roll-out has established itself, and along with this, how soon new schools start taking their use of handhelds into new territory. It must say a great deal about the technology (as well as the teachers) that this is happening so rapidly – so this is the major theme of this report. Whilst the Authority has done a great deal to publicise the project, if anything, it is my view as evaluator that the benefits of the scheme are being under- rather than over-stated. Their success rests significantly on the support package.” (Perry, 2006)

Perry identified the effective use of 'lead teachers' from phase 1 and the engagement in training as being key to the successful embedding of handhelds in the teaching and learning environment.

In the Autumn term 2005, as the second phase of the project began, the two teachers involved in the previous year were seconded to the authority for two days a week each to induct new teachers and visit schools to give them initial support. An adult education consultant also joined the support team, bringing expansion possibilities in that area. A programme of half-day

training sessions was implemented based on experience in the pilot phase and many background tasks were undertaken by the team to ease entry to the project for new teachers. These included for example, creating coordinated domain names for the different schools with standard registration procedures for each child; identifying new software applications and training in the basics of the operating system. Actions such as these are essential if the project is to stay organised through the large scale roll-out and be sustainable over time. Such overheads are a necessity rather than a luxury to ensure that project activities and procedures become an integrated part of normal working.

Efficacy of project learning outcomes

There are dilemmas facing educational evaluators who seek to draw inferences about the efficacy of innovative practices in schools. The more radical the changes in practice, the more difficult these issues become. How is the efficacy of mobile learning to be evaluated? Before attempting an answer to this question, we have to be clear who it is that needs to be persuaded. Pupils seem to be enthusiastic, but of course, if the handheld devices with which they have been provided meet their 'life needs', this will contaminate their view of the educational advantages. Parents seem to recognise advantages, but are likely to refer to a broader spectrum of criteria than educationalists. The critical people to be persuaded are the policy makers. Learning targets have been in place for many years in England, as well national curriculum tests as the means of assessing whether those targets have been reached. While 'high stakes' tests have their critics, policy-makers are unlikely to desist from auditing the education system by reference to pupil learning outcomes. It is more likely that they might be persuaded to examine the different *qualities* of outcomes achieved by M-learners. Research is needed to compare traditional pencil

and paper assessment with multimedia versions of the same demands fed through mobile devices, to offer insights into any differences associated with M-learning innovations.

Formative assessment practices, on the other hand, have established significant correlations with educational gains, (Black and Wiliam, 2006). Although from one perspective mobile devices offer consummately individual and personalised learning experiences, their educational efficacy is likely to be greatly amplified when the learner is networked into an extensive database or 'learning platform'. Such systems open the prospect of greatly enriched teacher assessment, the supporting evidence for pupil achievements being hyperlinked to virtual records of achievement. Wireless-networked devices can facilitate teachers' use of assessment for learning as well as pupils' self-review by making richly illustrated exemplification of past achievements and future targets available in e-portfolios. Indeed, set against such rich possibilities, traditional pencil and paper summative assessment evidence offers relatively impoverished evidence of M-learning outcomes. The notion of 'e-maturity' can be thought of as a characteristic not just of a learner or of a teacher, but also of an institution or a school system.

Shifting the focus of discussion from systems for recording outcomes to classroom processes, another radically innovative dimension of M-learning practice is deserving of analysis and evaluation. Learners' possession of individual devices invites possibilities of sharing ideas through the class IWB. Teachers' adoption of constructivist approaches to teaching and learning benefit from the rapid elicitation of and access to the ideas of all learners in a group or class via mobile devices. The multimedia representations available through M-learning devices offer unparalleled scope for learners to make their ideas known in whatever style they favour: using

words, numbers, sound, video, audio, animations, etc. Transactions around the expression of these ideas can be one-to-one, one-to-many, many-to-many or many-to-one (e.g. all learners to the teacher). For example, learners can present their ideas through the IWB and teachers can select from a group array in order to seek elaboration, justification, levels of agreement from peers, etc. A range of possibilities is beginning to emerge using wireless technology and software innovation that allows polling, ‘open’ responses and screen sharing through the IWB, as well as collaborative decision-making. These new communication tools offer unprecedented transparency to teachers and learners for ideas-sharing.

Despite some obvious attractions, the desire to scale up exciting innovation does not suggest a straightforward expansion. In the case of embedded M-learning, early adopting institutions are not necessarily representative of schools as a whole. Unless deliberately canvassed, little, if anything, will be known about the strategic thinking of those schools that have not yet availed themselves of the opportunity to engage with mobile learning. There is something to be learned from the insights of marketing in the context of consumers’ purchasing and adoption of innovative technology. Moore (2002) suggests that the ‘early majority’ (the ‘pragmatists’ who follow the first wave of ‘early adopters’) rarely reference the early adopters in their decision-making that may lead them to follow the same path. The suggestion is that the second wave needs to be convinced of the advantages of adoption in their own terms and in the context of their habitual ways of operating. Put another way, they need to be persuaded of the pragmatics of adoption. In marketing terms, they must be regarded as a separate market segment in any scaling-up strategy¹. Translated to the perspective of later-adopting teachers, there needs

to be persuasive pragmatic evidence that M-learning generates the kinds of practical outcomes that they find worthy of pursuit.

Given the radical nature of an innovation such as Learning2Go, an evaluation based on the pre-suppositions of traditional practices is likely to be inappropriately restrictive. There is a need to be open to the possibility of innovative uses and outcomes that might not have been on the formal educational agenda - a requirement to look for the unexpected. This stance will be in conflict with the performance criteria adopted by policy-makers – the signs of successful educational investment will tend to refer to traditional outcomes and practices. The ‘bottom line’ (or, in research terms, the crucial dependent variable) will be standards of pupil achievement – currently in England, as measured by end of key stage tests. However, innovative practices with novel hardware and software do not emerge fully-fledged. Though radical in parts, there are areas of under-exploitation as well as successes that must be propagated. An iterative action-research methodology, rather than an ‘arm’s length’ evaluation, is more likely to suit practitioners’ needs. Furthermore, given an intrinsically dynamic scenario, the management of change process has to be factored in, rather than assuming a static, ‘experimental’ stance. A way forward is to adopt mixed qualitative and quantitative methods, within a collaborative action-research model, in which the complementary skills of researchers and classroom practitioners inform one another around grounded practice. Within this mode of operating, traditional criteria denoting pupil achievements as well as innovative ‘blue skies’ outcomes can be accommodated.

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Footnotes

ⁱ Thanks to Mark Bird of Steljes Limited UK for drawing our attention to the interesting parallels between marketing and educational innovation centred on novel technology.

Figure Captions

Figure 1. Pedagogical vision underlying embedded mobile learning practices

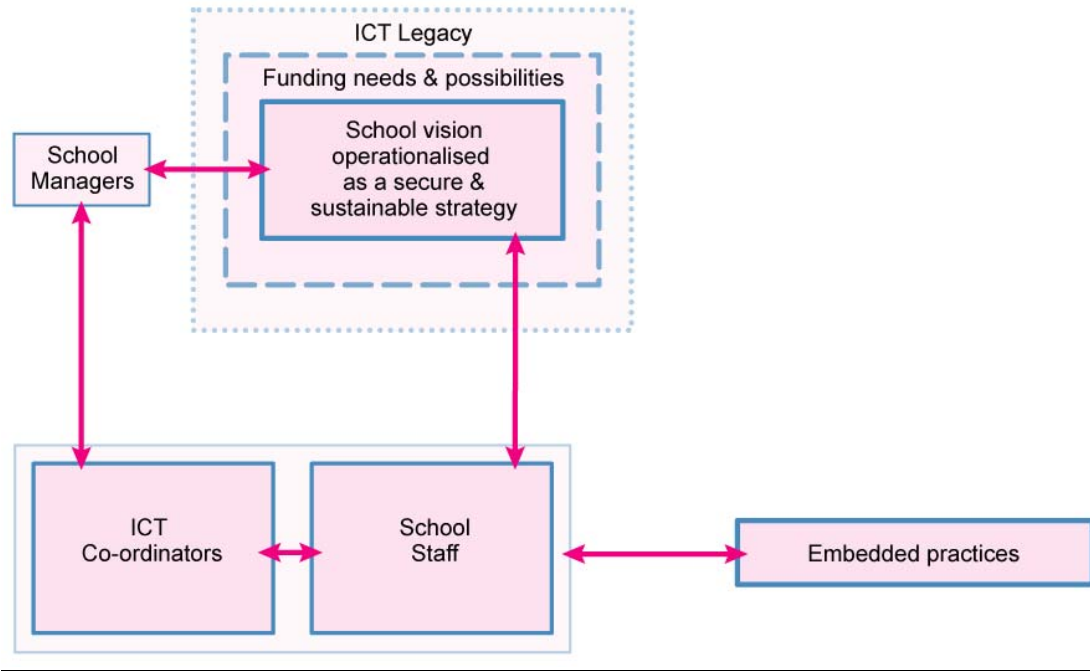


Figure 2. The addition of an Information Management System and support for e-portfolios

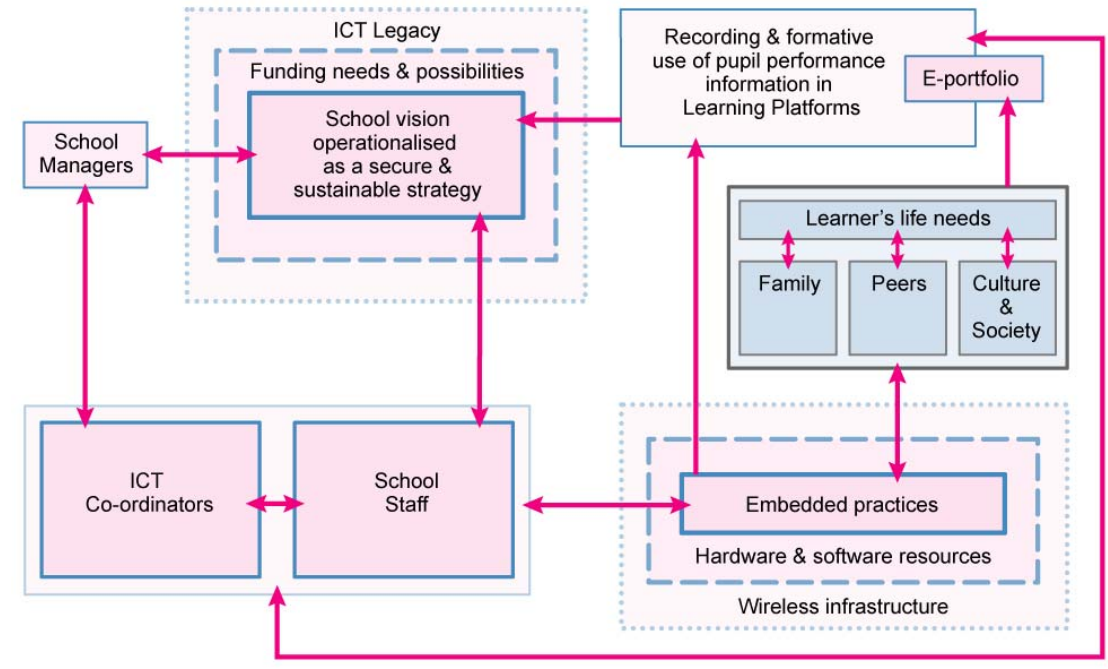


Figure 3. Three phases of digital resource implementation

