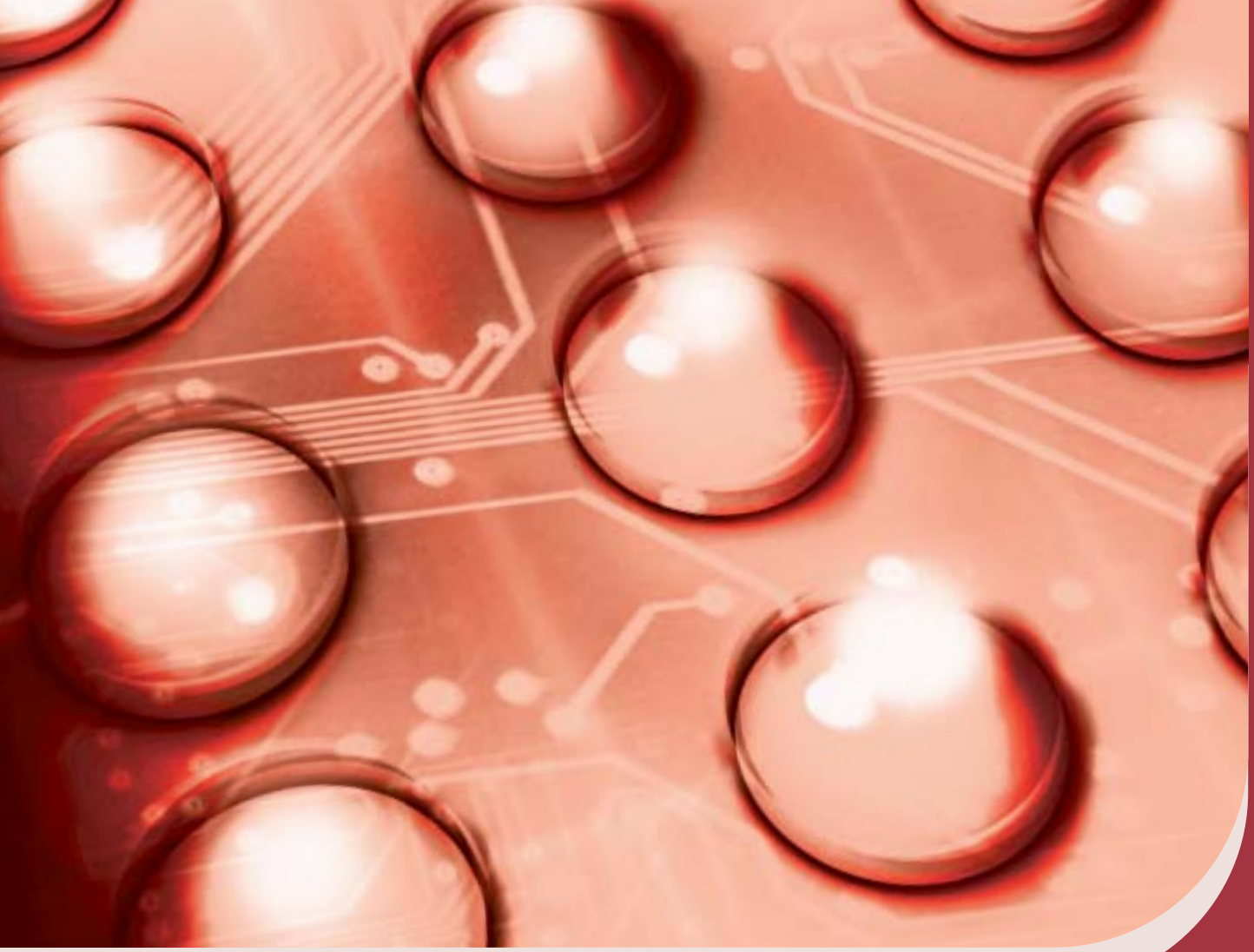

Using ICT to share the tools of the teaching trade

A report on Open Source Teaching
February 2004

Becta
ICT Research

in partnership with
DEMOS

About the authors

This report was written by Gillian Thomas and Matthew Horne of Demos who undertook the evaluation. Demos is a greenhouse for new ideas which can improve the quality of our lives. As an independent research organisation, its aim is to create an open resource of knowledge and learning that operates beyond traditional parties, identities and disciplines.

Demos connects researchers, thinkers and practitioners to an international network of people changing politics. Demos' ideas regularly influence government policy, but it also works with companies, NGOs, colleges and professional bodies – any organisation that can make change happen. Demos' partners share a desire to understand a complex, globalising world, and to play an active role in shaping its future.

Demos has a long history of work in education, the impact of information communication technologies, and organisational transformation.

About the project partners

Ithaca Associates [http://www.ithaca.org/] managed the overall programme of content development and field trial implementation, working closely with the South East of England Virtual Education Action Zone (SEEVEAZ), Becta, the DfES and various project stakeholders. Ithaca specialises in the identification and application of new ideas in education around the emergence of new computer and communication technologies. Ithaca has built strong partnerships between the public and private sectors in order to ensure a wide audience and an effective transmission of the lessons learned as a result of the field trial.

Xtensis [http://www.xor.ltd.uk/xtensis] is owned by XOR eLearning Ltd and provides a learning management system for delivery of e-learning utilising learning objects (LOs) that are flexible, reusable and interoperable.

The field trial and its evaluation were supported actively and practically by Becta and the DfES in keeping with their broader research agendas.

About the project

This research reports on the evaluation of the application of a distributed learning environment, served by a repository of rich learning-object-based content that can be adapted and integrated into local teaching and learning strategies. This key skills field trial has led to a broader discussion around an exciting area of technological and educational development as it has been applied in practice to a somewhat problematic curriculum area.

The work overlaps with other studies and projects relating to the use of learning objects and their application to the educational context. The project contributes significantly to knowledge in the field and provides insights into the feasibility of such approaches and the potential they may have in providing flexible, specialised and personalised approaches to teaching and learning. It also highlights the possibilities of public-private partnerships and cross-organisational collaboration.

Acknowledgements

The project teams would like to offer their most sincere thanks to all the staff and pupils involved in the field trial who gave their time and effort to the project. Special thanks also go to the SEEVEAZ staff for their enthusiasm and foresight in supporting the project.

[http://www.seeveaz.myschools.net/]

We would also like to acknowledge the steering committee, other stakeholders and the various content and software providers who agreed to participate in the project and offered their resources for use free of charge.

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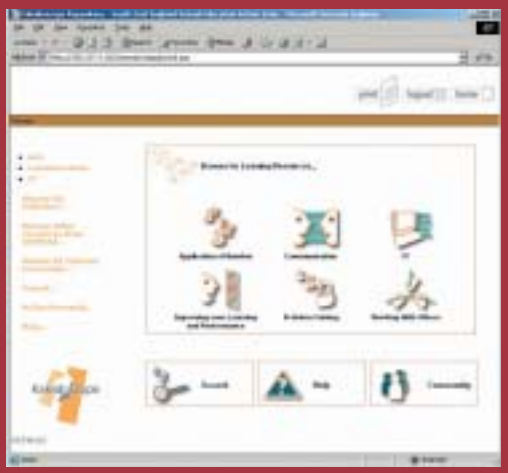
Aims and objectives

This report details the development, use and implications of Kaleidoscope, a learning object repository (LOR).

The LOR was established in December 2001 and was designed to promote the benefits of applying online reusable learning objects (LO) to support the delivery of key skills to a specific network of schools in the south east of England. The pilot was later extended to a number of FE colleges, and continues to be trialled cross-sectorally. The LOs were derived from a consortium of producers, including the schools and colleges themselves, and housed in an LOR, later named Kaleidoscope. The portal to the repository can be viewed at [www.k-scope.org.uk].

Throughout the report we refer to the LOR as Kaleidoscope, and to the project as the Kaleidoscope field trial.



The project was timely because key skills was a very new subject, which had been introduced in many of the schools following Curriculum 2000. This generally meant a lack of teaching materials and a desire for good ideas to help teach the syllabus. Additionally, as members of the South East of England Virtual Education Action Zone (SEEVEAZ), the first virtual EAZ, all the schools already had a history of working together and an ambition to maximise the use of technology in education.

As outlined in the original proposal to Becta, Demos' involvement was to evaluate the efficiency and effectiveness of the human and technological elements of the programme. Demos also sought to explore the impact of the project on the culture of schools involved: the educational, social and relational aspects of the school in order to evaluate the potential of this new technology to transform schools and related working practices.

This report aims to describe how the key skills field trial developed and was used in practice. It has not been possible to find reliable evidence of the direct impact of Kaleidoscope on the effectiveness of teacher practice or on pupil achievement. The sample of active teachers, and the number of students directly experiencing LOs from Kaleidoscope is too small. It is too early in the project to expect teachers to have used the LOR to construct new and innovative sequences of LOs and tested their effectiveness in the classroom and it is also too soon to measure improved pupil attainment as a result of this innovation.

However, we have been able to identify a number of models of how teachers have used the LOR. We have also identified a number of factors that affect the implementation of LORs in schools and developed a set of practical lessons for the future development of the field trial and for similar projects.

This report begins with a description and an analysis of the potential role of LOs and LORs in educational reform. It then goes on to outline case examples of how Kaleidoscope was used in practice and what factors influenced its use. The report finishes with a collection of recommendations for project managers, practitioners, policy makers and LO producers relating to the future direction of LO projects like Kaleidoscope and the wider policy lessons that can be drawn from this experience.

of the report

Methodology

The methodology used fell into three main phases:

- Pre field trial – ascertaining the conditions, such as attitudes to ICT, key skills and school-to-school sharing, which would affect the progress of the field trial
- Mid field trial – identifying factors which proved to be triggers or barriers to the use of Kaleidoscope; also looking at norms of resource creation in the teaching community and how this might fit with cutting-edge developments in e-learning
- Beyond field trial – looking at new communities of users, and opportunities outside the original scope of the field trial.

Each phase comprised a practice strand, where the primary focus was the progress of Kaleidoscope, and a policy strand, where we looked at broader developments in the education field. Each strand was complementary in terms of gaining a wide perspective of the implications of the project.

The field trial sample consisted of five secondary schools in SEEVEAZ. Two were technology colleges and one was a single-sex girls' school. Our sample extended during the course of the evaluation to include some evidence from a wider community (such as further education colleges) who became interested in Kaleidoscope.

Methodological tools used as part of the practice strand were:

- observation of training sessions (group and individual)
- teacher and pupil surveys
- collation of written and electronic communications
- in-depth interviews with project team and various stakeholders and partners
- in-depth interviews with key skills co-ordinators and senior management teams
- lesson observation and informal talks with pupils
- focus groups with key skills teachers.

As part of the policy strand of the research, we undertook:

- two expert seminars with speakers on the subjects of 'Open source approaches to teaching' with John Naughton of the Observer, and another, 'Learning objectives and learning objects', with Jonathan Briggs of The Other Media
- observation of Ithaca presentations to expert interest groups
- educational and e-learning policy analysis
- secondary research into LORs.

Educational policy context

'Excellence for all' has long been the goal of education policy. Achieving high standards of education for every learner has motivated initiatives as diverse as the National Curriculum, Ofsted, Curriculum Online, the National Literacy Strategy, the National Grid for Learning, Excellence in Cities and so on.

This report examines the potential offered by LORs - a new development in ICT – towards achieving the goal of excellence for all in the UK school system.

There has been a growing view in Government and elsewhere that uniformity cannot necessarily produce high standards of learning for every learner. The DfES has increasingly directed policy at customising or personalising learning to better meet the needs of every learner. Initiatives such as individual education plans, individual target setting, learning mentors, learning support units, Connexions services, modern apprenticeships, vocational and work-based pathways, and programmes for the gifted and talented have all begun the process of personalised learning for targeted groups of students but not for all students. The political challenge is now to make personalised learning a universal entitlement for every learner.

ICT offers teachers the opportunity to provide personalised programmes of study for every learner in mainstream school. ICT is of course already a top policy priority. The positive relationship ICT has with student motivation and attainment has recently been demonstrated by a number of Becta studies (Harrison et al 2002; Somekh et al 2002). However, the use of ICT is by no means a magic solution. The same studies have shown that there is no consistent relationship between the average amount of ICT and its apparent effectiveness in improving attainment. This obviously underlines how important the type of use is, and how it is tailored to individual learners.

Aside from the growing emphasis on personalisation and flexibility, government policy also emphasises the importance of continuous professional development, school-based innovation and the widespread sharing of good and best practice. These are seen as essential components of any strategy to improve educational attainment and outcomes. Investment in workforce reform, new professional qualifications, school-to-school networks and the dissemination of research findings, evidence of effectiveness and lessons from leading-edge innovation all rely on encouraging teachers to access teaching materials and guidance from a range of sources. They also rely on regular participation in the exchange of experience and feedback on the value and effectiveness of particular tools and approaches. Overall, the emphasis on more flexible organisation, and on higher and more transparent expectations that teachers will relate their use of particular methods and materials explicitly to evidence of effectiveness, is common across the whole of schools policy. However, a wide range of policies, initiatives and approaches is still being employed, with little consensus about the best ways to develop and spread innovative capacity or to relate teaching and learning more explicitly to norms of best practice.

The role of LOs – in this context digital teaching materials – is also rising up the political agenda. The recent consultation on an e-learning strategy outlines not only the policy goals for ICT in schools, but also the need to manage healthy marketplaces where good e-learning products and services can develop.

'We need to engage all publicly-funded developers, both commercial and educational, in agreeing the technical standards to be met, so that e-learning tools, assets, LOs, and virtual environments can be shared and reused across organisations.' (The e-Learning Strategy Unit 2003)

This is an important area, because as we go on to describe in this report, the biggest opportunity that LORs present for educational reform is to uncover the learning process. Anthropologists believe that cultures can be understood through the study of material culture (the objects and visual imagery that cultures use to communicate and describe). Using this parallel in the field of learning, teaching resources can be thought of as the material culture of learning. To date, the understanding of the relationship between teaching materials and the learning process has been relatively hidden because of the usually private nature of resource creation in teachers' lives. LORs can help uncover some of those processes. Metadata, interoperability and the sharing capabilities of LORs promise to enhance understanding of the material culture of learning.

The learning object

The Kaleidoscope field trial had at its heart a learning object repository. But what exactly are learning objects, and how do they work?

This section describes the characteristics of LOs and their homes, LORs. It then goes on to outline some of the potential educational benefits and implications of this new technology.

Very simply, LOs are reusable digital resources to enable learning. They have been defined by Wiley as 'any digital resource that can be reused to support learning'. (Wiley 2002)

LOs are bite-sized pieces of digital content. In isolation they can be hard to learn from, but when placed in sequence with other LOs they can enable learning. Not only is their sequencing important, but the mode of delivery matters too.

Experts have long sought a metaphor to explain this idea more clearly. One metaphor used by Polansi is that LOs should be thought of as words which have meaning on their own, but can only really facilitate learning when combined with one another in language.

'Like a word, an LO is abstract, but can be understood and shared among users. Similarly, as individual words cannot independently produce meaning, the LOs – self-standing and self-referential – in themselves are insufficient to generate significant instruction. Therefore, several LOs have to be brought together in order to create an instructional situation.' (Polansi 2003)

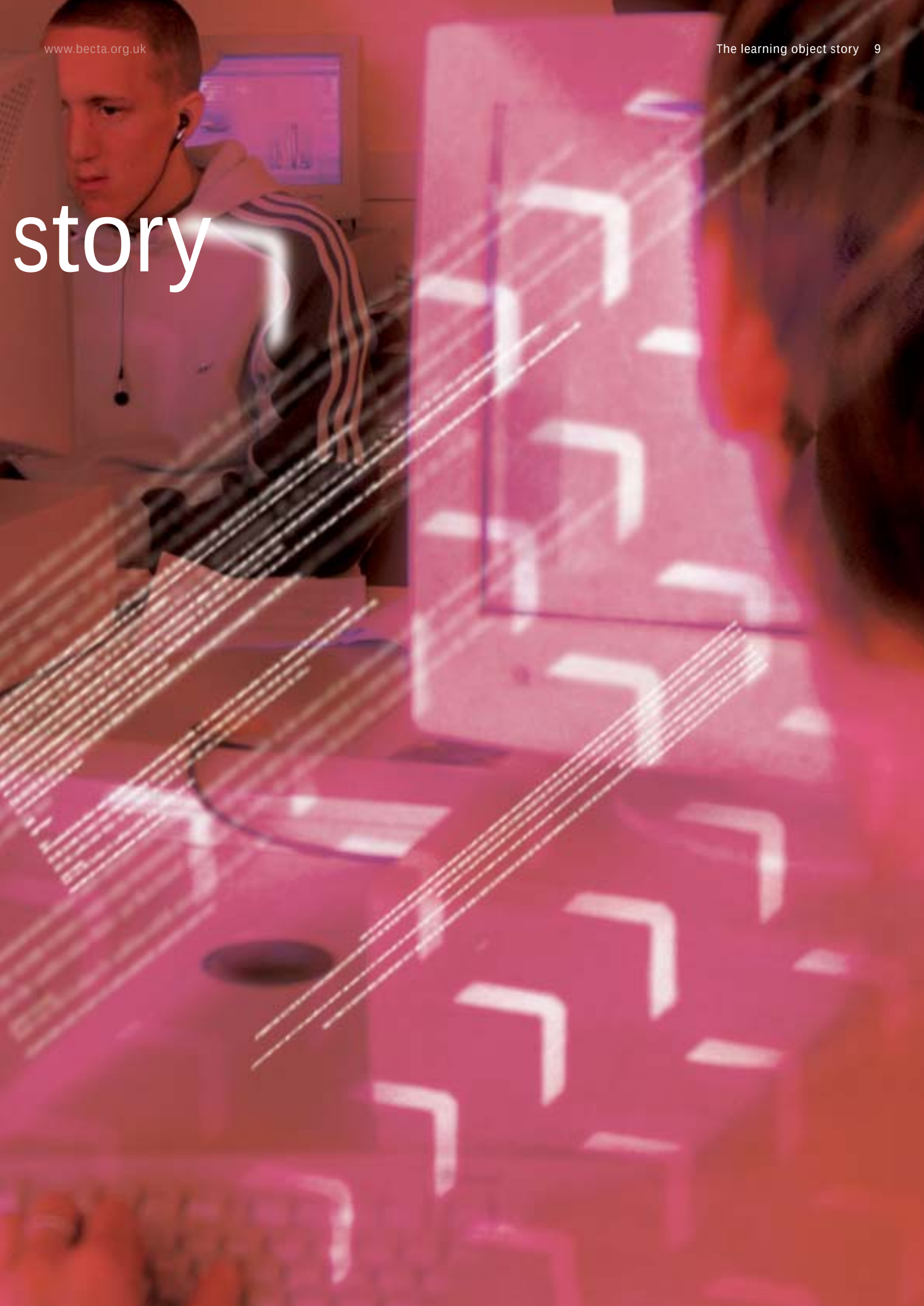
Other metaphors to describe LOs have included the Lego brick, though Wiley has criticised the prevalence of the use of this because it implies that any object can be combined with another. In the Kaleidoscope field trial the LOR became known as 'Kaleidoscope' as a metaphor for configuring relevant digital resources to support local community needs.

'Project participants can spin metaphorically on the kaleidoscope to find, share and create their own patterns and meaning from digital materials rather than being forced to view a pre-set "one-size-fits-all" configuration determined by an external provider.' (Ithaca progress report 2003)

LOs alone are not sufficient for learning to occur. How they are delivered affects the learning outcome. One of the great advantages of LORs is that they enable LOs to be delivered in a variety of flexible ways; for instance, they can be used:

- by teachers for whole-class or differentiated teaching
- by students for individual study or group work
- in low-tech paper-based environments
- in high-tech learning management systems or virtual learning environments.

story



Because of this flexibility around the delivery of LOs, it is often claimed that LORs are pedagogically neutral. Critics of LO approaches to learning claim that this pretence of pedagogic neutrality is aimed at disguising the influence of US models of pedagogy on LO development. These models are caricatured by the same critics as 'drill-and-test models of learning', where learners are 'empty vessels' and computers the 'pipe down which knowledge is poured'.

John Naughton describes this approach to learning as an 'impoverished view of learning: a factoid view of learning' where information is confused with knowledge, and information transfer confused with learning. This has sparked an academic debate about whether LOs are compatible with 'constructivist' theories of learning – where the learners are seen as active rather than passive and where their prior (mis-) understandings are engaged with and built on.

Learning tools that can be changed and modified

An important principle behind Kaleidoscope is the idea that the digital content of LOs can be changed and modified. They can also be adapted to meet the needs of particular learners. This turns teachers from consumers of content into producers of content:

'Being a consumer makes life easier. You just turn up with the materials and don't waste time. But producing is important to some teachers and it is how some teachers learn themselves. So there is nothing worse that having to use someone else's materials that you don't understand.'

Key skills teacher

To help us think about the relationships between LORs and teachers' practice we can imagine a situation familiar to many teachers: trying to give a lecture using some one else's notes. You can really only do this effectively if you have first studied the notes, discussed them with their author, modified them and then tried the new version out on your colleagues before delivering the lecture. In other words, the teaching material needs to be internalised before the lecture will be effective. Information contained in the lecture notes is cognitively and socially processed turning it into knowledge – that is, learning needs to occur.

The process of constructing and modifying LOs is a powerful learning experience. However, it is not the case that teachers will always be able to agree when an LO has been 'improved' and will lead to better learning outcomes for all students.

An 'open source' approach to software development by computer programmers relies on the fact that they can collectively agree when source code for software has been debugged. However, an 'open source' approach to the development of new teaching materials is more problematic because teachers cannot necessarily collectively agree that teaching materials have been improved once they have been modified.

Modification of teaching materials created by others (especially commercial providers) has huge implications not only for the effective spread of best practice, but also for intellectual property rights. Copyrighting learning resources, and especially electronic learning resources, can be a profitable business, with Thomas Telford School in Shropshire reportedly earning £2.5 million through sales of their online courses[1]. How the Government, industry and schools decide to deal with this issue will have a huge bearing on the style and uptake of LORs.

1 'Comprehensive sells online courses' BBC online, 21 February 2001.

Learning objects that can be pooled, stored and searched

LOs are housed in learning object repositories – storage systems that mark LOs with specific kinds of information (metadata) – to help users understand, find and adapt objects.

LORs are virtual filing cabinets for LOs. However, unlike filing cabinets, LORs have a multiplicity of ways in which the object can be described and filed. Metadata for an LO can include subject, level of challenge, level of interactivity and suitable learning style.

At Brigham Young University in Utah the 'metadata trade-off' is described as the fact that a smaller object means that you must provide a proportionately higher amount of metadata to ensure that it is discoverable in the storage system – and also that it makes it necessary to store and manage many more objects. (South and Monson 2002)

An LOR can potentially sort out the better or more popular objects to be more visible. LORs have been compared to the human memory, with its ability to make the more frequently accessed chunks of memory more easily accessible over time. So in the Merlot LOR in the US higher education sector, there are peer review categories for quality of content, potential effectiveness as a teaching tool and ease of use. If an object scores poorly in the peer review (below average), then the object is removed from the repository. (Keenoy and Papamarkos 2003)

Additionally, LORs have the potential to make 'intelligent suggestions' about what to present next to the learner. These features make LORs similar to virtual learning environments/learning management systems, which collect data about student progress and use it to inform prospective learning opportunities. If they use LORs to contextualise their teaching materials for specific students, teachers need to be able to tag their modifications with metadata that enables other teachers to identify for whom the material is now most suitable. In this sense, schools themselves would increasingly develop the characteristics of learning management systems that are able to personalise and tailor what is offered to each individual learner.

There is a move to develop a number of different protocols internationally. Most recent activity around LOs has focused on technical interoperability standards, or making sure that how objects are created and described remains faithful to agreed international standards. There are various competing formalisms such as Dublin Core. In June 2002, the LO Metadata (LOM) working group of the Learning Technology Standards Committee (part of the US professional association IEEE) produced the LOM data model standard. Essentially this is a step towards interoperability of LOs across countries and other boundaries.

It is important to note that interoperability is not just a technical issue. The current metadata standards for LOs tend to be technical rather than cultural, so there is concern that too little work has been done on the classification of LOs by type of learner, learning outcome and learning need. The small size and reusable nature of LOs can help to maximise their appropriateness in many different contexts, but even the smallest objects can be imbued with particular localised meaning that can be difficult to transfer. For example, the SEEVEAZ project found that some of the objects that had been created for the US further education market were difficult to transfer culturally to UK pupils, and indeed to teachers, who expressed dislike of 'Americanised' content.

Why are LORs important now?

For many practitioners in education there is a sense of having been here before: technological innovation is developed independently of any new ideas about learning and the education community is asked to respond to this innovation and work out how it can best be used. While many educationalists endorse the potential benefits of e-learning, they also observe a flood of poor-quality products in the market. One commentator has compared e-learning producers to used car salesmen because of their poor quality values. (Midgley 2003)

In this context, predictions about the future of LOs range from the deeply pessimistic to the wildly optimistic. They have been variously seen both as a threat to a learning model based on human interaction, and also as a golden solution to some of the most common obstacles to learning. Whatever your position on LOs, their development is certainly in an opportunistic phase. Heppell describes how the most innovative phase in the development of the internet was the period after the establishment of the worldwide protocols, but before the massive corporate mergers that occurred from 1993 onwards. He describes the space between the 'denial' of new technologies and the 'adoption' of new technologies as the space for maximum innovation and opportunity (Heppell 2000). LORs are in this phase: the technology has received investment, but widespread adoption has yet to happen.

It is clear that LOs and the repositories that house them could take off in a number of different – or indeed multiple – directions. For example, one school's aim might be to make it easier for pupils with learning difficulties to access resources, while another institution might want to use technology to improve financial viability through altering the ratio of teachers to students. It is possible to imagine LORs operating in a wide variety of different contexts. We have summarised some of the main drivers behind use of LOs in four categories: the efficiency route, the teacher-centred route, the pupil-centred route and the freedom argument.

The efficiency route

There is a lot of duplication in teachers' work which could be reduced if they worked better together rather than harder alone. This position is based on a straightforward desire to achieve better results within an existing system through increased efficiency. However, some educationalists question the model of learning that is assumed in the argument that *LOs deliver industrial economies of scale*.

The teacher-centred route

There is a wide variation in the quality of teaching that could be improved if teachers shared and improved one another's teaching materials. School improvement occurs through teacher-to-teacher dissemination of best practice (rather than top-down dissemination). In this sense it can be viewed as *LO creation as co-production*.

The pupil-centred route

There is wide variation in the learning needs of students, which could be better met through LO-based management systems that differentiate instruction according to individual need. This argument starts with a moral case for accessible learning opportunities for all. There are also various campaigns on behalf of excluded groups such as those with special educational needs, gifted and talented students, students excluded from schools, adults who left education early or children in developing countries. In this sense the argument is *LOs are scalable and networked*.

The freedom argument

Teachers tend to be passive consumers of teaching materials developed and published by corporations. Should teaching materials be developed that were free/non-proprietorial then the profession could take ownership and control over the development and production of the tools of their trade. This is essentially a libertarian view of informational transparency. The centre of gravity of this debate is around power relations, censorship, copyright and intellectual property and that *LOs set knowledge free*.

Clearly there is overlap between these drivers, and the motivations behind LORs will often be multiple. However, classifying drivers in this way can help to illustrate some of the potential futures for LORs while also highlighting some of their conflicts.

The efficiency argument was used in establishing the SEEVEAZ key skills LOR. At the outset of the project, the core question was:

'How do you deliver key skills to large cohorts of sixth-form and college students with variable aptitude and ability, without high levels of funding, significant extra staffing capacity or significant extra time capacity during the school/college day?' (December 2001)

Over time, this vision seemed to change slightly and evolve towards the learner-centred argument, which is more focused on tailor making resources to diverse needs:

'To develop and evaluate the infrastructure and support systems required to enable the configuration of digital resources to support diverse community needs.' (July 2003)

This ambition is echoed in the words of one of the practitioners involved in the Kaleidoscope project.

> *'I think the main driver is about making learning for the pupil more individual. Online materials tend to give you more flexibility. So you can get support materials for the weaker, and extra materials for the more able students. There's also a big desire to make things more enjoyable and more interesting. I think technology helps with that.'*
>
> ***Key skills co-ordinator***

Of course, there is a clear overlap between the learner-centred and the efficiency-centred arguments, and it is important that both are present in the vision for the field trial. The shift to a more learner-centred rationale does seem in tune with both the potential for the technology in teaching institutions, and with current policy directions.

Case examples from

Teachers were broadly positive about Kaleidoscope as an idea. They liked the facility to pick and choose from different providers, including material from teachers in other schools.

They felt that this matched well with their existing behaviour, and also seemed designed to provide students with a variety of materials. They also liked the fact that Kaleidoscope was free.

'It's quite exciting, finding the good bits, especially because it's something you haven't had to sit down and slog over. It's something that you would ideally really like to do, as long as it works and the kids enjoy it.'

Teacher

Although teachers liked the Kaleidoscope idea in theory, in practice their use of Kaleidoscope was limited, mainly because of the problems surrounding key skills – the subject area on which the Kaleidoscope field trial focused. There was also a fairly wide spectrum of technical ability and access to computer rooms among the teachers. Use of Kaleidoscope was therefore patchy, and took very different forms in different schools.

The section below contains case examples of where teachers had used Kaleidoscope, and how this had affected their practice in:

- independent study for students
- whole course creation
- use of commercial materials as a package
- publishing and viewing materials from practitioners
- extended communities – Kaleidoscope in further education (FE) colleges
- continual development.

Kaleidoscope

Independent study for students

'I used the repository to get documents like letters. Then I copied and pasted them and adapted them and put them on our own website. Then the more able students, when they've finished in the communication lesson, go off and find a computer and do some of those exercises.'

Key skills co-ordinator

School A found that its key skills communication course lacked adequate teaching resources. The main communication teacher was not particularly confident with ICT, nor were any of her communication lessons timetabled into computer rooms. However, she was keen to create some online materials.

The key skills co-ordinator worked with her to create a resource for students that included tips for presentations and discussions, specifications for the portfolio, information on the exam and interactive exercises for students to complete. In this way students could easily access worksheets and exercises to complete in their own time outside of lessons. In practice, students used this facility during a number of different circumstances such as when they finished a lesson early, when they had missed a lesson or during revision time. The availability of this resource was particularly helpful for higher-ability students who completed exercises in class very quickly.

'The communication teacher is very IT illiterate, and she'd be the first to say that about herself, so using the repository by herself would be a bit of a mental leap for her. But the way we've done it – getting students to access materials through our website – has worked well and we've had some good feedback from the students.'

Key skills co-ordinator

The integration of ICT in subject areas like English or communication was thought to be extremely worth while, even though teachers of these subjects were not always particularly ICT confident. The reason that these teachers believed that ICT could make a difference in all subjects is backed up by an experience in a neighbouring school:

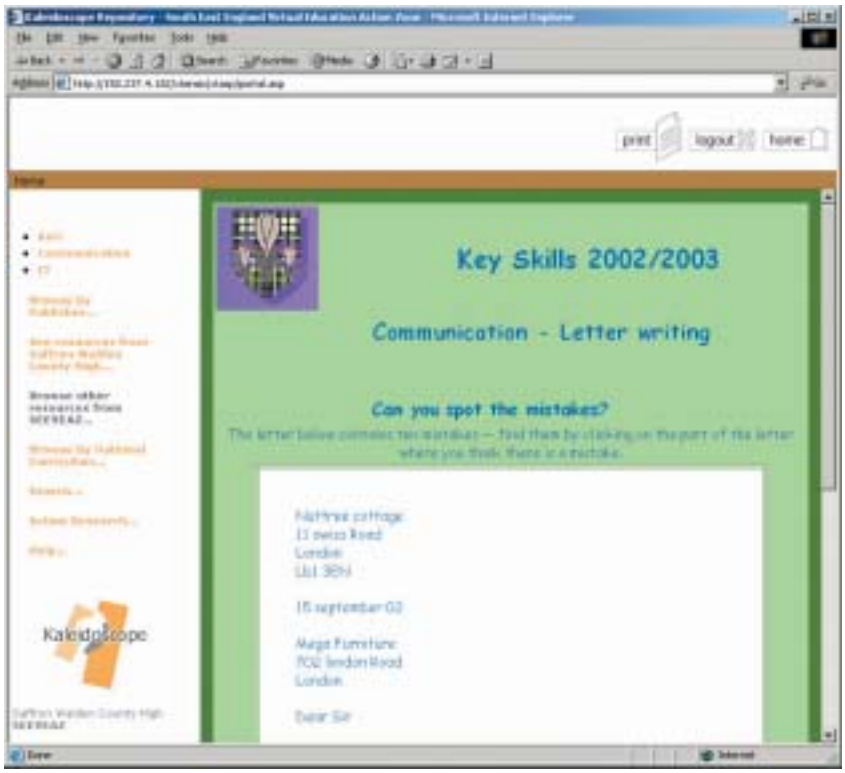
'They seem a lot more confident communication-wise. They'll get up and make presentations to the class, you know. They'll do it well, using PowerPoint to back it up – and they do it without thinking. They don't seem to be daunted by it at all. They're very strong in that area, I think.'

Teacher

It is too early to say how the use of e-learning resources affected school A in terms of pupil learning. The school had not monitored use of this part of the website, though the key skills co-ordinator had received positive verbal feedback from students who had used the resource. The practice did not seem to have had a significant impact on results, however, since a significant number still failed the exam. At Communication Level 3, out of 140 entered for the exam only 44 passed it.

Nevertheless, this small-scale innovation did succeed in a number of respects:

- raising the technical confidence of the communication teacher
- forging a small-scale resource-creation partnership between a pair of teachers
- making learning more adaptable for students, especially higher-ability students.



It is important to note that in this school the pupils were accessing some Kaleidoscope materials, but via their own school website, not via the Kaleidoscope site. This was because the teacher wanted to use a site with which the pupils were familiar and where they would not get 'lost'. This meant that the key skills teacher was downloading materials from Kaleidoscope to the key skills section of the school's website.

A next stage of development in LORs should be a consideration of how pupils themselves might be able to access LOs direct from the LOR.

'It would be good to build up files for the students to access online without them getting into the "teacherly" bits.'

Key skills teacher during training session

The notion of getting students to access teaching materials directly is potentially huge for a number of reasons. Firstly, most teachers across the five schools acknowledged that pupils found ICT motivating and engaging.

'They still like going into the computer room. It does motivate them and it's not just the novelty.'

ICT co-ordinator

Secondly, there were already efficiency gains in terms of teacher' and student' time that were being achieved through ICT use.

'There are lots of improvements. The intranet has really helped connect the whole school. We use it so much. All the files are on the intranet, so we have a page explaining each lesson. There are guidance sheets for things like PowerPoint and Access. Now I can't imagine a time when 'I wasn't there that lesson' might be a valid excuse, because we just direct pupils to the intranet.'

ICT co-ordinator

Teachers thought this type of 'connectivity' could only be enhanced by securing a proper student interface onto an LOR.

Creating entire courses

One school emerged as particularly active in creating e-learning resources through a combination of self-written resources, self-sourced resources (especially the BBC) and resources accessed from the LOR. These resources were then posted onto a section of the school website which provided a wealth of resources for two key skills (ICT and communication) in the school year 2002–3. The whole look and feel of the website is a considerable departure from the style of commercial packages.

'We have semi-deliberately made every page look different. All the resources are from a variety of places, and it helps people know where they are up to if it all looks different. The thing with commercial providers is that it all looks the same.'

Key skills co-ordinator

Having this resource helped to reduce the burden on teachers who could sometimes feel that they had been landed with an unpopular subject that they had no, or little experience of teaching. Having a website to use helped those teachers feel supported and guided in their work.

The website is now being used again for the school year 2003–4, with a number of modifications where teachers have learned what works in the classroom and what does not.

'There are going to be some minor changes to pad out some of the areas where they were finishing things more quickly than we thought, especially on the spreadsheets.'

Key skills co-ordinator

The teacher involved in this project is now developing a second online-learning site for the school, aimed at pupils in years 10 and 11 studying ICT.

'I'm going to create an online resource which will provide a whole course – a really complete self-teaching course. I have used the repository for that and I will be using it some more too. I ploughed through and found some nice animated and interactive material, mainly from commercial providers. I did find some interesting stuff from another school as well.'

Key skills co-ordinator

An initial design of this new course and the facility to see how different students are progressing is shown in the screen below.

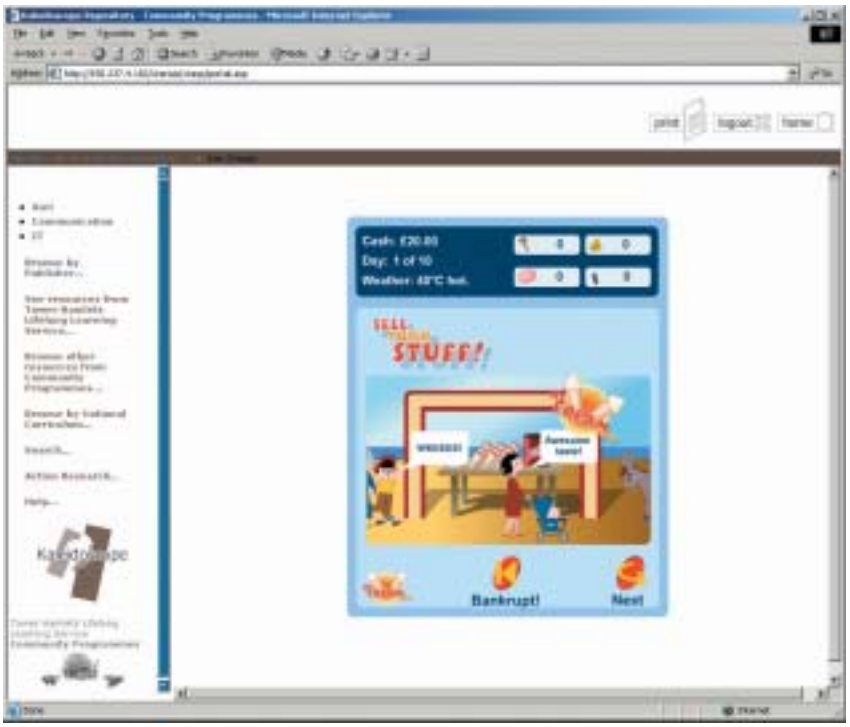
The provision of good, accessible, and self-explanatory resources worked well at this school. Teachers liked it because it reduced the amount of preparation time, and pupils liked the fact that they could work at their own pace.

'The website has been really popular with the three teachers teaching the IT course. It means that there is no preparing and the students are able to directly access the material. We have had examples of students doing things at home as well.'

Key skills co-ordinator

'It's good because when you've finished one bit, you can just go on to the next one.'

Key skills pupil



Again, it is important to note that although both of these websites draw on Kaleidoscope materials, neither site directs pupils onto Kaleidoscope itself, preferring instead to download objects and post them elsewhere. This is because Kaleidoscope was not seen as an appropriate interface for students. This did seem to inhibit teachers from creating 'path objects' (sequences of objects pasted together) on Kaleidoscope, leaving this innovative function relatively unused.

The impact on student learning of this innovation has yet to be proved. Pass rates for the key skills exams are still lower than the school was hoping, although most teachers acknowledge that key skills is still settling down as a subject. Most of the gains from the website seem to be on efficiency and teacher confidence, and to what extent this is beneficial to student learning is still an open question.

'It [the website] is pretty effective, and makes the lessons easy, but of course it is difficult to judge how much is really going into heads. The instructions are almost a little bit too good to challenge them.'

Key skills co-ordinator

Use of commercial materials as a package

One school began to use materials from the LOR in their lessons on application of number. The benefits of this were felt to be multiple. Firstly it cut down on the preparation time in advance of the lessons because the teaching resources were already available to use. Secondly, the interactive nature of the materials helped to engage pupils in class. Lastly, there was a great deal of flexibility in how the resources could be used.

Where a projector was used, the whole class could engage in exercises. In other situations the teacher was able to print out worksheets to hand out in class or for homework. These features were really thought to help engage pupils more effectively in their learning. There is also some evidence that this practice overflowed from key skills lessons into regular maths lessons.

'The teacher really loves the material. It makes it so easy to teach. It's just a question of going through the resources. All the stuff is there – simple! He uses printouts but also his laptop and a projector so they can look at problems in class.'

Key skills co-ordinator

The practice of using e-learning materials in this way was largely the result of one very enthusiastic teacher who was confident in his own ICT skills.

The use of a whole online course has implications for who might be qualified to teach that course and teachers are very aware of the impact this can have on their role.

'For some of the online courses, it may turn you into a facilitator and not a teacher. And that's quite challenging when they expect you to know, and you say, "Well, give me some time and I'll probably be able to work it out."

Key skills co-ordinator

This case example is interesting because most of what this particular teacher was using was sourced from a single publisher, Direct Ed. Other materials were also used, but in general this teacher favoured the Direct Ed materials. He felt that they were of a good quality, simple to use, interactive and tonally right for his pupils. This shows that while teachers like LORs because of their ability to pick and mix different materials, there is also a great potential for teachers to lift off a large number of LOs and then teach them as a package – indeed as if they had not come from an LOR. This example shows that it is not easy to predict exactly how individual teachers will use an LOR.

Publishing and viewing materials from practitioners

Three of the participating schools had their key skills resources published on the LOR for other users to view, adapt and use. Initially this was done in conjunction with an Ithaca trainer, but a couple of teachers have since independently published their own materials via the Kaleidoscope control station.

There are clearly some barriers to the sharing of resources by teachers. These barriers can be broadly summarised under three headings:

- Quality: 'It's not good enough'
- Time constraints
- Sense of competition with other schools.

Quality

The first barrier was a common concern among teachers, but it was not significant enough to actually prevent them from contributing materials for the site. The rating system introduced later in the field trial was a bit of a double-edged sword for teachers who liked the idea of being able to find good materials quickly, but were a bit worried about what other teachers might say about their work.

'There's still too much stuff of too little value, but the rating system will help with that. I haven't rated anything yet. I'm scared because of what people might say about my stuff! I will rate stuff, mainly out of a sense of duty.'

Key skills co-ordinator

Time constraints

Teachers often mentioned the barrier of time as being an issue in their propensity to post materials on the LOR. While they had been happy to post materials on the site as part of the field trial, they felt that in the future, as the project became bigger, the lack of time or incentive to post up materials might prevent Kaleidoscope from reaching a critical mass.

'Isn't there a danger that people are likely to just take things out of the repository without putting things on?'

Teacher in training session

'In principle people don't have a problem with sharing. But once you've got what you want and messed around with it, you have to be altruistic to put your material back. There's an extra process involved – it is extra work that teachers don't need to do – there needs to be some form of incentive.'

Teacher in training session

The project team, who are developing a potential business model for the future of Kaleidoscope, are considering this issue. One option might be to pay contributors to the site. Another might be to incorporate Kaleidoscope into a continual professional development programme where teachers can gain recognition for skills in ICT and material creation.

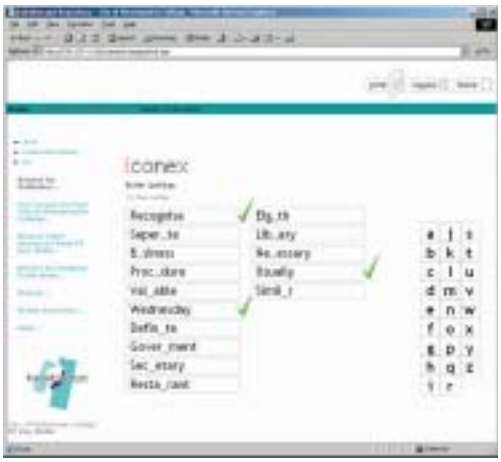
'Some people can be funny about sharing resources on the net. I've heard teachers resist sharing knowledge on the intranet with pupils because "what if their mum's a teacher?" People are funny about it, and we've got to get over that.'

Key skills co-ordinator

Competition with other schools

Few teachers mentioned this final barrier to sharing resources. It was not a major issue in the field trial in SEEVEAZ, perhaps because the schools were already collaborating together. However, it is important to acknowledge that this barrier may prove very significant for some teachers and schools in the future.

There were not many examples of teaching resources making the leap from one school to another via the LOR and being used in a key skills lesson. This is largely because the uploading of schools' own materials occurred relatively late in the field trial. Despite this, a couple of users of the LOR told us that they had looked at the materials from other schools with great interest because they were keen to see the resources from schools known to have good GCSE and A-level results.



'I do spend a lot more time looking, than I do using [Kaleidoscope]. But I don't think that devalues it. You need to look and doing that is informative in itself.'

Key skills co-ordinator

We predict that a major driver in looking at the repository in the future will be the curiosity of teachers to find out trade secrets from schools with particularly good reputations. In our sample, school C seemed to arouse most interest from other schools wanting to know about their practices. This is an interesting example of how collaboration (in sharing materials) and competition (wanting to do better than others) can co-exist in projects like the Kaleidoscope field trial. It illustrates that the 'search by institution' function within Kaleidoscope is an important one and will probably become the most used.

Extended communities – Kaleidoscope in FE colleges

Kaleidoscope is now being extended into communities beyond SEEVEAZ, with a number of FE colleges getting involved. Ferl has contributed materials to upload onto the repository, and a collection of educationalists currently being trained on Kaleidoscope are beginning to search and use materials. It is too early to analyse how these materials work in classrooms, but it is worth mentioning how teachers have responded to Kaleidoscope in the training sessions.

In the training sessions, FE teachers identified a wide range of applications for Kaleidoscope in their work:

- one-to-one exercises in support work
- whole-class demonstrations with a projector
- printed worksheets for completion in class, for homework or as a diagnostic
- self-directed study in class.

'With this, it is good to actually demonstrate the difference. I think it is a good example to show our kind of student: the young adult. Especially with boys, you need that sort of thing in order to show the point.'

FE teacher talking about Direct Ed interactive materials

'I edited it to make it more what I wanted. I am quite conscious of using too much paper, so I made it into columns to reduce the pages. And I edited it a little bit to make it easier too. But in the end I decided not to use it. It is too difficult a diagnostic.' FE tutor on the process of analysing and adapting Kaleidoscope materials for use in the classroom.

An interesting implication of the extension of Kaleidoscope into other communities, such as FE colleges, is that it has made the possibility of cross-curricular applications of resources much more explicit. LORs are ideal for helping different courses or institutions to identify resources they can share through the intelligent use of metadata.

'It would be possible to map the requirements of some subjects across others using the metadata, so tagging it for English or key skills. I can see that being really useful for Esol [English for speakers of other languages] as well.'

FE teacher

In the future, this capacity has the potential to highlight some of the commonalities in what learning means in different sectors such as schools, colleges, universities and adult education.

Continual development

Kaleidoscope has not been static during the span of the field trial. In a process of continual feedback from teachers and other partners, the technology has evolved. New developments and features include:

- new export methods for LOs including Microsoft LRN player, learning management system (LMS) or intranet
- multiple-branded web interfaces and customised routes into the content, based on the user's institution
- gathering feedback on individual LOs through a rating system and an action research facility.

There are still some unanswered questions, for example how to ensure stability of URLs. Kaleidoscope continues to incorporate these into the development of the technology.

This culture of feedback is an important and positive feature of Kaleidoscope and was part of how teachers participated in the project. It confirmed the nature of the project as **not** an off-the-shelf product. However, there were some disadvantages as users did encounter some imperfections. This was experienced for example in LOs that had not been designed to be disaggregated, LOs that were not tagged with sufficient or accurate metadata, or difficulties in downloading objects because of firewall or security problems.

It became clear that teachers would not promote a resource like Kaleidoscope widely (for example outside their departments) in schools during the early stages of development. This reinforces the importance of small working groups, action research and 'joined-up' leadership as demonstrated in the SEEVEAZ partnership, in trialling new online innovations.

One of the rewarding aspects of the project for teachers was seeing how their suggestions had been implemented in Kaleidoscope's design.

'The rating system has been a good step, and it seems to be generally getting better all the time.'

Key skills co-ordinator

'I think the repository has become much better over the last few months. It has become much more user friendly. There are extra controls, and it seems to work better with fewer problems.'

Key skills co-ordinator

'It seems to know who I am when I log in. And you can search by institution, which is good.'

Key skills co-ordinator

The action research facility in particular helps to ensure that there is a continual loop between use and development. Teachers undertaking the action research, which is accessible from the front page of the portal, are encouraged to be reflexive about the usefulness and purpose of resources they have found. As well as the action research there is a simple rating element, which can be completed for each LO individually.

The potential value that innovations like the action research facility in Kaleidoscope represent is huge. Engaging teachers in co-constructing a system potentially transforms them from passive deliverers of a knowledge store into active learners themselves. This kind of feedback system could also be integrated into continuing professional development (CPD) opportunities. It is easy to imagine such a facility extending into use by learners as well as teachers.

Factors affecting the a learning object rep

It is clear that a wide range of factors is related to the success of Kaleidoscope. These factors could be clustered into three different groups: issues relating to technology, the curriculum, and teacher culture.

We would argue that teacher culture is at the heart of this dynamic as it is the interaction between curriculum and technology that affects the overall outcome of such an innovation. Understanding how teachers use technology to deliver the curriculum is key. In order to introduce an LOR into a school environment successfully, one must ask two questions: how do teachers currently develop and use teaching materials, and how can an LOR build on that current practice in ways that improve learning outcomes? Below we detail the salient characteristics of how the teachers participating in the project created their teaching materials outside the context of Kaleidoscope.

- Diverse sources: most teachers created teaching materials from a wide range of different sources such as downloads from websites, commercial packages, textbooks, adapted worksheets, published articles, images and pictures, materials from conferences.
- Individual practice: the process of gathering these materials was usually informal and done by individuals in isolation from colleagues, with a great deal of variety in teachers' personal preferences for different teaching materials.
- Adapting: teachers were accustomed to altering and adapting resources to suit their own purposes.
- Independence: most teachers were receptive to commercially produced materials, but were reluctant to become too heavily dependent on just one provider. They tried to avoid what they regarded as 'monolithic and inflexible courses'.
- Sharing materials with colleagues: this was the strongest locus of collaboration, but sharing teaching materials between departments varied widely within and between schools. In one school the maths department was singled out as being 'really into online learning' and 'having a lot of stuff on the intranet', which meant that the maths staff used digital learning materials and were used to sharing these materials electronically.
- High-trust relationships: teachers were more receptive to sharing teaching materials with a trusted 'friend' with whom they had a sustained professional relationship. The culture of creating resources collaboratively did seem to be growing, albeit in very small groups.
- The culture of departmental resource creation was problematic for the key skills field trial because the key skills department was frequently poorly defined and had little or no budget for resources.
- Electronic sharing: the schools were in the process of storing more teaching materials on their internal file-sharing networks, though there was great variation in the practice of individual teachers and departments. This development was driven by the desire for greater efficiency and reducing the amount of replicated work.
- Collaboration between schools: the Education Action Zone had initiated some projects involving resource sharing and collaboration between schools. However, outside these projects, resource sharing between schools did not really happen (except for some teachers who swapped materials with teachers in other schools who were peers from initial teacher training college).

success of
ository

Beyond this, there was a collection of other factors wielding influence over how Kaleidoscope progressed. These are summarised below.

A clear rationale for LORs

For an LOR to be introduced and implemented successfully, a clear rationale for its use is vital. Generating clarity about the purpose of such an innovation is crucial, as is clearing up any misinterpretations. This can be particularly true of ICT projects which, for many teachers, are a source of worry about depersonalisation. It is perfectly acceptable for the rationale to evolve over time and, in fact, as the potential of the LOR and the needs of the schools become clearer, so the rationale should evolve.

The rationale for Kaleidoscope was a central component in the recruitment of schools into the field trial. The introduction of the key skills policy presented the schools in SEEVEAZ with a problem: they lacked low-cost yet high-quality teaching resources suitable for use by a group of teachers trying to teach a new syllabus. In other words, there was a gap in the market for key skills resources and Kaleidoscope offered a solution. In fact, many teachers, including heads and deputy heads, mentioned this as a reason for their enthusiasm for the field trial and for getting involved in it in the first place.

Leadership commitment and resources

Commitment among teachers, managers and school leaders to delivering the curriculum using an LOR is essential to the success of such an innovation. The creation and use of an LOR requires considerable investment in resources by the schools involved, including money and – most crucially – time, for groups of teachers to work collaboratively together.

Although Kaleidoscope filled a gap in the market, demand for teaching materials was lower than expected. This was because key skills was not a high overall priority for the SEEVEAZ schools, especially those that focused predominantly on academic achievement and university entrance. This relatively low priority was reflected in the resources available to key skills co-ordinators, some of whom had no budget for photocopying, let alone for buying teaching materials. In two schools key skills teachers were asked not to set homework in order to enable students to focus on their AS levels. This policy reduced the demand for teaching materials like activities or worksheets for students to complete outside of lessons. In some of the schools, there was no release time to develop teaching materials or to observe and support the practice of colleagues.

External funding cannot always compensate for the effects of leadership commitment and resources in schools. In fact, reliance on external funding may indicate lack of commitment and resources within the school. SEEVEAZ funded release time for key skills co-ordinators in 2002. Their joint meetings were used both to discuss how they could best organise and respond to the changes to key skills at a national level and also to exchange teaching materials that had proved useful. However, more could have been done at this stage to front-load Kaleidoscope with materials that were actually being used in classrooms.

Demand for digital teaching materials

Not only is it important for the curriculum area to be a well-resourced priority for the school, but also the structure of the curriculum needs to be well suited to the use of large numbers of LOs. For example Key Stage 3 physical education, drama and dance may well be important and well-resourced areas of the curriculum, but they may not require the use of many digital LOs.

Demand for teaching materials provided by Kaleidoscope was also lower than expected because of the emphasis in the syllabus on gathering portfolios of evidence. In some of the lessons observed, teachers devoted all their time to helping pupils complete their portfolio of self-study/coursework. These lessons emphasised gathering evidence of key skills achievement and application in other AS-level subjects, rather than key skills development and acquisition. Thus they used very few new teaching resources. (As an aside, it is important to record that all the key skills teachers interviewed thought that the balance between evidence collection and skill development was inappropriate.)

However, there is plenty of evidence to suggest that demand from students for electronic LOs is high across a wide spectrum of subject and interest areas. For example, one recent Becta study found that, for most pupils, the time spent using computers at home greatly exceeded the amount of time they spent using computers in schools. Many pupils categorised what they did at home as 'games' but further probing revealed that there was much educational value in what they pursued in their leisure time. There was, however, a significant digital divide – with over a quarter of pupils having no access to the internet at home (Somekh et al 2002.) Turning this home demand of ICT interactive materials into a learning experience while also addressing the digital divide should become a significant priority for the development of LORs.

Attitudes towards technology

Teacher and student attitudes towards technology and the curriculum are important to the success of an LOR. Attitudes to technology were very important for the key skills field trial. All the key skills co-ordinators involved in the project thought that ICT was of crucial importance to the future of their school. Surveys indicated that there was a great deal of agreement between teachers and pupils concerning the importance and value of ICT.

The teachers are very confident in their basic use of ICT – more confident than any other school I have worked in.'
ICT teacher

'The school has been very generous and the strategic planning is good. We are doing well in combating the "computers don't work for me" mentality.'

ICT teacher

However, it is likely that the sample for this project was unusually pro-ICT compared to other schools. It is very likely that issues such as access to computer rooms, speed of internet access, quality of ICT training for teachers, and a narrow conception of what ICT can do to improve student learning (for instance, over reliance on PowerPoint) would all present even more significant barriers to using technology such as Kaleidoscope in schools with a lower historical commitment to ICT than the SEEVEAZ schools.

Developing a strategy for overcoming an 'anti-technology bias' among staff should be a central consideration when extending the reach of Kaleidoscope and projects like it. A simple but useful tick sheet for encouraging staff to use technology has been developed by tutors at Brigham Young University in the US. Teachers need to:

- know what hardware exists
- know where the hardware is available
- know what its physical condition is and whether it will be useful for a particular context
- know if the software and hardware are compatible
- know whether they have the know-how to work it.

(South and Monson 2002)

Attitudes towards the curriculum

Positive attitudes towards the use of digital LOs are not sufficient: they have to be matched by positive attitudes towards the subject matter as well. Staff and student attitudes towards key skills were far more negative than their attitudes towards ICT. The introduction of key skills has not been popular with either teachers or students. Several key skills co-ordinators reported difficulties in filling teaching slots, as some teachers were unwilling to teach the subject. Many teachers, including members of senior management teams, believe that key skills will have 'disappeared' within five years. In fact, three of the five schools no longer teach key skills as a discrete subject and the other two teach only some of the key skills to a proportion of students. The most popular explanation for this ambivalence and reluctance on the part of pupils and teachers concerning key skills is the common perception that university admissions procedures do not recognise the UCAS points awarded for key skills.

Between 2002 and 2003 we noted some improvement in attitudes towards key skills in an *ad hoc* survey of students and teachers. The total number of respondents agreeing with the statement, 'I think key skills are really important and should be a priority for our school,' rose slightly.

Kaleidoscope is not entirely reliant on the future of key skills in its current form. Although it is currently used for storing key skills teaching materials, the architecture is already in place to extend its use into the rest of the curriculum.

The wider policy environment

Innovations like Kaleidoscope are sensitive to changes in policy. The introduction of LORs benefits from a relatively stable and predictable policy environment. In the first two years, key skills policy underwent major changes nationally that created operational problems in schools. As a consequence, significant changes were made concerning who taught key skills, who studied key skills and how it was timetabled. This instability and uncertainty relating to the future of the policy meant that in some schools the individuals responsible for teaching key skills changed each year, making it very difficult to build up a community of practitioners whose use of the LOR was sustained over time. This change was disruptive for the key skills field trial. One of the biggest factors to affect Kaleidoscope was the instability in staffing for key skills.

Organisational capacity for technology and the curriculum

It is important for schools wishing to use LORs that they already have a well developed capacity for the use of ICT and for the specific curriculum areas concerned.

The schools in the Kaleidoscope field trial are all at an advanced stage of development in the use of ICT at the school. All the schools had well developed strategic planning for technology and support at senior management level for ICT. Some of the schools were technology colleges or CISCO academies and all were members of the SEEVEAZ. All schools had invested in ICT hardware and software as well as the relevant training for staff. All full-time teachers had laptops, and most departments had digital projectors. Schools had introduced ICT into school administration procedures as well as into classroom teaching practice. However, the schools are not identical in their approach to ICT. One of the schools invested in hardware earlier than others, so much of that now needs to be replaced. Some (but not all) schools had a well managed and well used file-sharing network for sharing teaching materials.

The schools involved in the field trial did not have such strong capacity to deliver key skills as they did to deliver ICT. There was wide variability between schools in how key skills was taught. The amount of timetabled lesson time per week for key skills ranged between 120 minutes, 110 minutes, 75 minutes and none at all. Some schools taught key skills to all Year 12 students, while others used proxy qualifications to exempt students. The number of teachers used to teach key skills varied widely between schools, irrespective of how many students studied the subject. As we have seen above, the staff teaching key skills changed each year, as did the curriculum model that the schools adopted.

Discretionary effort and incentives

The success of innovations like Kaleidoscope depends greatly on the discretionary effort of teachers. The enthusiasm of school-based managers who champion projects like Kaleidoscope needs to be nurtured, as does the enthusiasm and commitment of project leaders who are asked to work across many schools connecting the work of others. The lower-than-expected level of demand for teaching materials in SEEVEAZ does not indicate that key skills was a low priority for the committed key skills co-ordinators.

These individuals invested much discretionary effort to improve the learning experiences of their students – searching for, adapting and reusing teaching materials from a range of different sources. We found that engagement with and use of the LOR have relied heavily on the discretionary effort of school-based managers. Interestingly, the most advanced use of the LOR was by a school-based manager who had the flexibility of working part time and who used her own personal computer to engage with Kaleidoscope.

Recent developments have shown that key skills is a much higher priority in FE colleges, adult and community learning providers and for organisations like Mencap, for whom basic and key skills development is a core part of their business, their identity and their area of expertise.

Conclusions and rec

Based on the evidence relating to how the Kaleidoscope pilot developed in different educational contexts, we have made a number of recommendations. They are divided into three main sections:

- Project management
- Wider policy lessons
- Future research.

Project management: when is a community ready for innovation?

This section of recommendations is focused on learning about project management from the Kaleidoscope experience. We aim to describe what might be the necessary requirements for establishing a successful community of resource collaborators. Our conclusion is that communities cannot be 'ready' for innovation: it is the taking part in innovation that creates readiness.

There is already a bank of existing research into how educational communities can innovate together. Demos has been thinking and writing on this issue for some time. Our findings from the Kaleidoscope evaluation confirm much of what Demos and other researchers have described. That is that the establishment of reciprocity, reputation, face-to-face meetings, senior management support, space to discuss ideas and shared and agreed goals, are all important for successful and innovative partnerships[2].

More specifically we outline below some of the main lessons from our observation of the collaborating community engaged with Kaleidoscope.

2 Specifically Axelrod's (1984) requirements for the possibility of co-operation are these.
- Arrange that individuals will meet each other again.
- They must be able to recognise each other.
- They must have information about how the other has behaved until now.

ommendations

Identify and communicate simple

The focus of the collaboration must be specific and discrete and offer a clear understanding of its application. The focus of the collaboration has to be something that all participants really want. Teachers are more likely to invest time and energy in a project that is 'infrastructural' – an innovation that will benefit everyone in their core job of teaching. Painting a picture of the goal of the project in terms of learning outcomes is needed to engage people. Emphasising the method, such as using ICT, will not be enough to motivate anybody but the most technically minded.

In Kaleidoscope's case, building a community based on personal satisfaction and a desire for excellent learning materials was the driver – ICT was merely the tool by which these creations could be pooled, searched and stored effectively.

'It's not enough to say to the kids, "This is a technology course, go off and do it." It's got to be integrated into how you actually teach.'

Key skills/maths teacher

Communicate in a commonly understood language

Effective communication is also vitally important to the success of a project. Teachers tend to prefer plain English, whereas this is not always the case with technicians, policy makers or academics. The Kaleidoscope project found that discussion of technology among experts was likely to include terms such as content, granularity, repository, control station and scratch list, while discussion of the same topic among teachers was likely to include terms such as materials, worksheets, stuff, websites and read only. A good project manager or trainer may involve some element of translation or use of metaphor in order to avoid alienating practitioners who are perfectly able to grasp complex ideas, but do not want to describe them in overly complex ways.

Leaders need to motivate others to collaborate

In order for a collaborative project to work between schools, there ideally needs to be two leaders responsible for the project in every locality. One of these leaders should be at a senior level, and should be involved in supporting practitioners, organising release time for training or development, and recognising and rewarding excellent work.

The second leadership position should be established at a more hands-on level. This is because an LOR project needs to be seen to be developed by teachers for teachers and must be driven by practitioners with credibility among their peers. In Kaleidoscope this was the role of the key skills co-ordinators, who would typically use the LOR and then prepare materials for sharing with colleagues in their school in the traditional way.

School-based leaders need to be capable of motivating and encouraging their colleagues to participate. A technical platform that enables collaboration is not enough.

'I have passed on all the information to teachers – sharing with them where I can – and talking to them about how to use the materials.'

Key skills co-ordinator

Build critical mass

Using an LOR can be really valuable if plenty of other people are also using it. Unfortunately on that basis no LOR would ever get off the ground. In other words, some people have to invest a lot of time in the LOR before it offers acceptable levels of return.

Identifying and incentivising teachers who are prepared to make that initial investment is important. Above all, a strategy is needed for achieving critical mass as quickly as possible. LORs work on the principle that the quality of teaching materials can be improved only if many teachers are using, adapting and republishing materials, and that this in turn generates data about what materials work best for different groups of learners.

'One problem … is that LORs will not necessarily be nurtured over the long term to enable a sorting system to reach a critical mass. Not all teachers will be committed to participation, especially at the beginning.'

Project partner

LOR projects should begin with realistic targets for numbers of participants and frequency of participation. To achieve the stated number of participants, the net of collaboration must be thrown at least twice, or even three times, as wide as that number. This is because the Kaleidoscope project, and other educational participation projects, have had an extremely high level of 'lurkers' or 'silent participants'. (Riding 2001)

Recruit existing effective communities who already share materials

Identifying and recruiting existing effective communities who already share materials is an important first step in developing LORs. We also recommend that these groups use content that is already familiar – ask them to use the LOR as the tool for the way in which they work now.

Currently the unit which is most effective in collaboration is the subject-centred department, so it should be a fruitful start for any new LOR. Some schools in the Kaleidoscope pilot have aligned key skills with their school's departmental structure, so maths teachers teach application of number and English teachers teach communication. The result is that key skills have been more integrated into core teaching activities and it is here that we have seen greater engagement with the LOR.

However, it is also true that the departmental focus can be quite narrow and not always a good basis for innovation. A number of teachers complained to us that it was too easy for 'powerful' departments to crush or ignore new initiatives such as key skills. This is why some schools had taught key skills in discrete lessons, rather than integrating it across subjects.

An alternative to the departmental level of collaboration might be to invest more in the personal networks that teachers themselves establish. A community of old college friends, for example, would be an ideal way to pool resources in high-trust relationships, while also drawing on a diversity of experience.

Overall our findings about 'rules of collaboration' have much in common with existing knowledge in this field. However, every project is unique and it is important to point out that there is a need to talk to participants openly about how, why and when they want to participate in projects of this kind. Additionally, it is clear from this research that mainstream education, despite much political interest in networks and partnerships, does not always incentivise collaboration in everyday school life. The reasons for this are discussed in the next section.

Wider policy lessons: how can LORs personalise learning?

Personalised learning and collaboration between schools are currently two major strands of governmental thinking around the future of education. Individualised environments are already a key issue for Ofsted, and the National College of School Leadership (NCSL) has pioneered networked learning communities across the country.

Collaboration is a key ingredient in innovation, and schools are not always collaborative places. Teachers are increasingly likely to ask, 'What's in it for me?' Teachers are certainly motivated by the self-interest of improving the attainment of their own students. The notion of sharing, copying and reusing the work of others, especially those in rival schools, can conflict with the norms of individualised assessment and school performance.

For example, one teacher described the tension between wanting to help all children and wanting to withhold some investment for oneself.

'We've put some of our resources on the repository. I don't know how much we would continue putting on there. It depends on how altruistic we are feeling. I think we are quite altruistic as a school – it's good to help all kids and not just the ones you're teaching in your school, but we're not totally altruistic. I think it is nice to contribute: you don't lose anything and it doesn't reduce the quality of what you're doing yourself, but you don't want to be the only one contributing.'

Teacher

Of course, as the practice surrounding Kaleidoscope illustrates, a spirit of collaboration and competition can coexist healthily between schools. However, actively collaborating with rival practitioners can be a leap of faith for some schools.

This is one illustration of how the structure of existing schooling has great potential to create reform, but also to quash it. Key skills is also a good example of how new ideas, even with the backing of many teachers, can struggle in schools. Key skills is a subject which promises employable skills and the facility to cross-reference across subjects to provide a more coherent experience for the learner. For example, it is possible for a learner to be engaged in application of number in geography lessons. Yet some of the dominant structures and practices in education, such as the departmental structure, a rigid and full timetable, a highly formalised assessment procedure and so on have helped to stall the progress of key skills.

Of course, time is needed for educational change, and key skills may yet succeed as a policy initiative. However, the point remains that certain forms of personalisation can be very difficult to achieve within an already ingrained system.

Personalisation and collaboration are at the heart of what Kaleidoscope and LORs are about. Our experience with Kaleidoscope suggests the following recommendations for an education system more in tune with the values of personalisation and collaboration. This section uses the experience of Kaleidoscope to recommend useful practices in helping to achieve these policy goals.

Promote digital resource creation as craftsmanship for teachers

ICT on its own cannot deliver personalisation. However, ICT is a great tool for working towards this goal. ICT can help teachers know their students better. The more information teachers have about the student, the more it is possible to present or restrict particular exercises just for them. While the potential for ICT to personalise learning is widely acknowledged, it is also important to note that many teachers suspect a strong emphasis on ICT from Government as a possible threat to 'real' (face-to-face) personalisation and, for some, this can be a barrier to engaging with new technologies. There are also the known skills gaps among the teaching community in ICT. Part of the problem is that teachers will not engage with technology if they believe the only driving force behind investment in ICT is cost efficiency.

For these groups it is important to convey the potential for ICT to work in partnership with human input to create a new kind of craft. This could be done by more explicitly acknowledging the teacher as skilled craftsperson whose hand-made products have equal, if not greater value, than those published by 'experts'. Shifting the focus of teachers' craftsmanship onto ICT is already happening in some schools, but needs to happen more in others through strong leadership and appropriate training.

Embed resource creation and sharing into teachers' professional identity

Emphasising the professional aspect of resource creation/adaptation is also important. Teachers have a strong professional identity, but this identity has little to do with their role as producers of materials. Teachers need permission both to believe that they are producers of good materials, and also that they can and should share their work with others outside their department. The open source software movement and the practice surrounding reusable LOs in repositories should be used as guiding examples for encouraging teachers to view and transfer their work. Part of giving this permission could be achieved quite simply through good internal communication in schools. Additionally, sharing as a resource-creation technique should become a more explicit part of teacher training and CPD courses. However, these methods alone will not develop a resource-creating community.

Our research suggests that the most powerful way in which good practice is transferred is through peer-to-peer networks. For this reason, small-scale projects which embody good resource-sharing practice, such as Kaleidoscope, should also be funded to help create nodes of good practice that can then be more widely promoted through existing discussion forums such as the media and educational conferences.

Trial new forms of assessment

There is a danger that real personalised learning is abandoned as soon as the learner comes to be assessed. Then, the learner is one of a cohort being anonymously examined. For some, this can compromise the whole learning experience, as the incentive is to create a factory system which optimises output rather than people. LORs can potentially create a more personalised assessment procedure through a number of innovative functions.

LORs, in conjunction with sophisticated computer software such as virtual learning environments, can create personal pathways for individual students through a wide and engaging variety of LOs. Some of these may need teacher input, while others may not, but the capacity of the technology to collate data about the completion of the objects helps to ensure that assessment is not arbitrarily divorced from the learning process. From the learner's perspective, a continual feedback loop between assessment and learning can be part of the LOs themselves.

Trialling new forms of assessment that take advantage of new functions presented by technology is already an exciting part of education. LORs, and their potential to link to sophisticated databases, promise to further blur the boundaries between resource creation, learning and assessment. At its best, this could create an ongoing cycle of improvement.

Encourage hybrids between commercial and home-made teaching resources

Many teachers really value commercial teaching materials because of their high design and production values. However, some teachers are limited in their ability to really personalise these commercial teaching resources in a way that suits their individual students. Often this is to do with skills gaps in technical ability or design know-how. Issues around plagiarism and copyright can often stilt partnerships between professional producers of materials and practitioners who may have different ideas of how they want to use those materials. Additionally, not all teachers can be technically literate enough to create high-value learning resources themselves.

LORs are an excellent tool for teachers to stitch together a variety of LOs (into path objects) so that a lesson or course becomes more tailor-made than the original producer could have envisaged. What is needed is for teachers and commercial producers to have the capacity to collaborate without compromising the business feasibility for producers. One option might be to develop a specialist cohort of teachers trained in more sophisticated production techniques. These teachers would adhere to a code of practice among teachers who are producers.

Copyright is a real issue, and we do not claim to have all the answers here. However, we would recommend that rather than trying to restrict information, new forms of assessment that make plagiarism less attractive need to be looked into – for example, making the assessment specific to the learner's context.

Policy makers should have more exposure to the real tools of the teaching trade

The relationship between policy makers and practitioners can be a strained one. The main forms of feedback, such as Ofsted inspections and exam results, are based on performance rather than being embedded in everyday practice. This means that the truth of classroom practice can be relatively hidden from funders and reformers wanting to encourage best practice. This is a serious deficiency in the policy-to-practice feedback loop.

ICT is an ideal space for 'safe' learning to occur between practitioners and other related partners such as producers or policy makers. But it is also true that ICT itself can be unappealing or even intimidating to those more accustomed to face-to-face experiences. Already many ICT-based projects have discovered that setting up a discussion web page or an email distribution list will not automatically engage teachers.

LORs are a link between the real and the possible. They can be embedded in the reality of teachers' lives (in the materials they use day to day), but the LOs they house can be reused, adapted and combined to create new possibilities. This makes them an ideal method of communication between educational partners.

Next steps: what research will help LORs embed in practice?

The previous section showed how LORs could play a part in educational reform. However, we do not expect them to become a central part of educational systems overnight. LORs are still a relatively new technology whose worth has yet to be proven. Further research is necessary to really understand where they would be best placed to achieve positive results.

Careful siting of research pilots against background variables

The danger with research pilots is that they are intended to use a specific tool or innovation in isolation from the broader range of variables. However, as we have seen from Kaleidoscope, the marginal nature of some curriculum areas or school activities can undermine the effectiveness of a specific tool. If an innovation is to be introduced in line with teachers' own habits, there is a risk that it will follow the *status quo* unnecessarily. However, for a chance of mainstream adoption to occur, there also needs to be a degree of fit with teachers' own habits. So, there needs to be a balance between relevance to existing practice and the encouragement of new behaviour.

For this reason the siting of research sites needs to be carefully balanced against background variables and, in particular, the curriculum area.

Build best practice at the margins of 'normal' education

One potentially fertile area of new research into LORs could be among learners with disabilities and learners who are highly gifted. These groups of learners are significant because they are at the ends of a spectrum of ability, where personalising learning is more advanced and accepted than it is in mainstream education. Researching the uptake and impact among these learners would be instructive in understanding best practice in LOR creation, as well as a potential advocacy tool for future use in other areas. The SEEVEAZ schools already have programmes targeted at groups who are gifted and talented which could potentially be tied into the Kaleidoscope project. Similarly, Kaleidoscope is forging partnerships with organisations such as Mencap which need highly individualised materials to help build the confidence of disabled learners.

Of course, there are many other communities with a specific interest in more personalised education.

Challenging or physically remote circumstances tend to make innovation more necessary. Prison inmates, black and minority ethnic (BME)/asylum seeker and refugees (ASR), dyslexics and home-schoolers are all groups where ICT is already playing an important part in education and where LORs could become quickly embedded. Trialling LORs in these communities will be a valuable step to building an increased differentiation of materials mapped to particular learning styles.

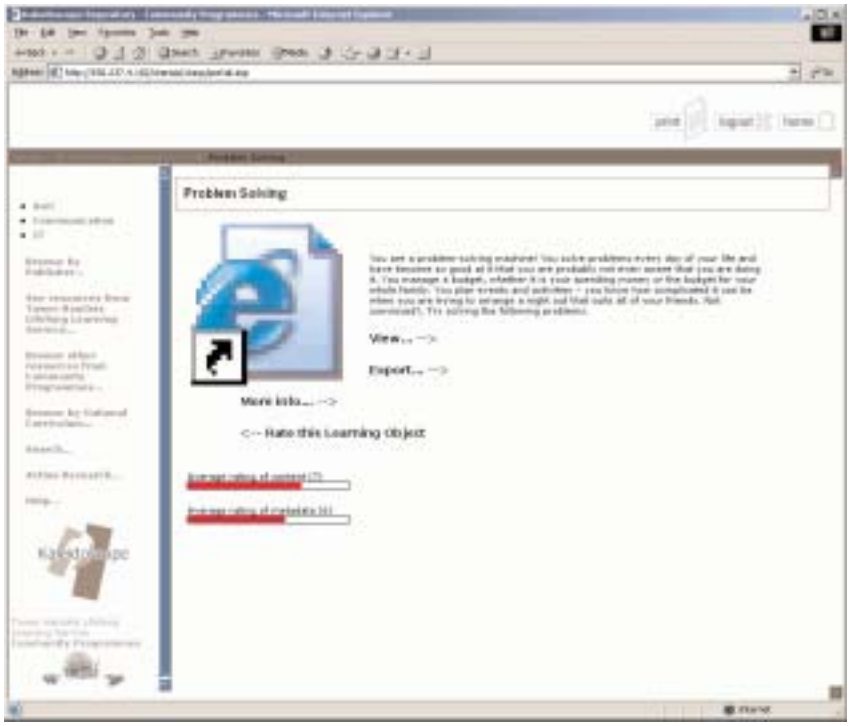
Establish a better understanding of the practices and preferences in user feedback

We are a long way from being able to establish the precise impact of LORs such as Kaleidoscope on pupil learning and attainment. However, what we do know is that a significant source of additional value is the prior user feedback present in the selection of learning materials. This user feedback is significant because it is independent of the views of any central authority, or indeed the intentions of the product designer. The Kaleidoscope example demonstrates how there are some hesitations that teachers have in revealing their views, yet there are also plenty of drivers to do so, including a sense of professionalism, curiosity, or fair play. The role of more explicit incentives for contribution, which could take the form of continuing professional development or even financial reward, is currently a gap in our understanding LOR potential. How to incorporate feedback into learning materials and, more widely, how to establish norms of peer review should continue to be an important strand of ICT educational research.

Involve learners in rating and co-creating objects

This research confirmed that a key motivation for teachers in resource creation was that the learners should enjoy and engage with materials. Teachers pointed out that it was not always easy to predict what learners would like or dislike, so experimentation was important. Some small-scale analysis of this process was occurring in some of the SEEVEAZ schools. For example, one teacher had devised a questionnaire for feedback on course materials. However, the Kaleidoscope project did not initially key this into the dynamic between teachers and learners in a robust way.

A next step for future research would be to try LORs with learners themselves. The contribution of the learner is all too often absent in educational research. LORs could be one tool by which learners semi-formalise their contribution to their own learning. They could, for example, rate the material and even get the chance to personalise their own learning. A natural step from this might be to enable parents to access their children's work and interact with teachers at the same time.



Bibliography

AXELROD, R., 1984. *The evolution of co-operation.* New York, Basic Books.

E-LEARNING STRATEGY UNIT, The, 2003. *Towards a unified e-learning strategy.* London, Department for Education and Skills.

HARRISON, C. *et al*, 2002. *ImpaCT2: the impact of information and communication technologies on pupil learning and attainment.* Becta.

HEPPELL, S., 2000. 'How might e-learning really change educational policy and practice?'. *Education Futures*, RSA/Design Council

KEENOY, K. and **G. PAPAMARKOS**, 2003. *SeLeNe Report: Learning Management Systems and LORs*. London, Birkbeck College, University of London.

MIDGLEY, S., 2003. 'Distant choices'. *The Guardian*, 28 October 2003

POLANSI, P., 2003. 'Use and abuse of reusable LOs.' *Journal of Digital Information* **3**(4).

RIDING, P., 2001. 'On-line teacher communities and continuing professional development'. *Teacher Development* **5**(3).

SOMEKH, B. *et al*, 2002. *ImpaCT2: pupils' and teachers' perceptions of ICT in the home, school and community*. Becta.

SOUTH, J. B. and **D. W. MONSON**, 2002. 'A university-wide system for creating, capturing and delivering LOs'. *The Instructional Use of LOs*. D. A. Wiley. Bloomington, Indiana, Agency for Instructional Technology/Association for Educational Communications and Technology.

WILEY, D., 2002. 'Connecting LOs to instructional design theory: a definition, a metaphor, and a taxonomy'. *The instructional use of LOs*. D. Wiley. Bloomington, Indiana, Agency for Instructional Technology/Association for Educational Communications and Technology.

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