Link^{ER}

Linking Digital Libraries and Virtual Learning Environments:

Evaluation and Review

Interim report on DiVLE emerging issues

LinkER Deliverable D2

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Review of recent developments, achievements and trends in the DiVLE area

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Link[ER] – *Linking Digital Libraries and Virtual Learning Environments: Evaluation and Review* – is a ten-month project being undertaken by the Centre for Research in Library & Information Management (CERLIM) at the Manchester Metropolitan University and the Centre for Studies in Advanced Learning Technology (CSALT) at Lancaster University. Details of the project's work and copies of published reports are available at http://www.cerlim.ac.uk/projects/linker.htm

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Introduction

This interim report summarises key issues emerging from ongoing project activities as identified by the projects, expert informants and stakeholders. It is based upon the formative evaluation reports presented to the Programme Manager at the end of February 2003, upon on-going discussions between Link^ER staff and the projects, upon discussions at Programme Meetings and other dissemination events, and upon materials disseminated through project websites. It must be stressed that these are provisional findings and will be subject to review during the remainder of the Programme.

1. Project Management Issues

1.1 Staffing

The short time lapse between the awarding of funding and the commencement of work meant that some projects did not have the staff they needed in place at the project start date, despite this being an explicit selection criterion. Several projects reported delays in recruitment, often hampered by institutional HR processes which could not be circumvented. The secondment process in particular seems not to have worked as expected, and it may be that projects need to be clearer about what will and will not be permitted by their institutions. Institutions, which must of course sign off proposals to the JISC, need to be quite clear as to what they are undertaking in responding to short-term Programme calls.

Despite these delays, no project reported that their work had been significantly adversely affected by lack of staff. Any problems have been overcome by the redistribution of work among existing staff, and also the use of placement students, though the efficacy of the latter strategy will need to be monitored carefully.

Projects have asked whether JISC might be able to intervene with institutions to persuade them to make a ‘special case’ to speed up the recruitment process in any future programmes, though better liaison with HR departments at the proposal stage may prove a more effective initial tactic.

1.2 Planning and process issues

The JISC will oversee and monitor the progress of funded projects. This will include recognition that in groundbreaking work there may be failures as well as successes, but that all such experience can provide valuable information for the community. It is also recognised that aims and objectives as well as the technological context can change, and that individual project objectives may need to be renegotiated over time.[1]

Despite careful initial planning and scoping, what is 'theoretically true' has not always turned out to be so in practice and it is noted that in some instances projects have had to adjust their expectations in the light of experience when they came to 'do the work'. Indeed several have emphasised the need to be flexible and adaptable. Sometimes, original plans may have been over-ambitious and there has been a need to refocus upon what is possible within the timescale, while prioritising other activities for the future in the light of what has been learned. Some projects are working within a broad and active institutional context where it is relatively easy to refocus their 'groundbreaking work' so that there will be positive outcomes. Others are more narrowly defined and their progress is therefore more exposed. It is worth re-emphasising that JISC values the surfacing and documenting of all types of experience, not just of success.

The funded projects will consist of short practical explorations, implementation pilots or focused studies. The aim of which will be to provide generic outputs which will be of benefit to the wider community and assist the JISC to identify areas for further development.[2]

An interesting observation was that a 'local fix' may be desirable to ensure success, but might not be scalable to the wider community. Behind this comment lies the tension between providing something of use to the institution while at the same time trying to fulfill JISC's needs and expectations. Observations or insights into how to manage this balance, as well as explicit detail on the local solution, might also be of value to the wider community. At this stage in the Programme it is too early to draw conclusions, but projects should be encouraged to record the local fixes they have found necessary and to provide reflective commentary on the issues these raise for implementing their findings generically.

[1] JISC Circular 7/02 item 20
[2] JISC Circular 7/02 item 11

1.3 Project Evaluation

Each project will need to build in evaluation activity in its project planning to collect necessary data throughout the project.[3]

Evidence of evaluation activities includes the use of familiar tools such as questionnaires, interviews, focus groups, user group meetings, scenario building and testing, and the development of demonstrators.

However, it is not always apparent that an evaluation plan as such is in place, or that evaluation of the progress of the project is being carried out as a routine activity. There is some evidence of confusion between 'product user testing' and 'project evaluation' and projects may welcome guidance on this.

The particular issue raised here concerns the differences between:

- The testing of products, which in essence is designed to check the conformance of a product (or a service) to its specification. For example, the project may have developed a functional specification in the early stages of its work; later both project staff and users recruited for the purpose will be engaged in checking that the product does indeed meet the specification. This is an essential step, and is closely related to quality assurance procedures (though the latter will be broader).
- The determination of the effectiveness of the project and, most critically, of its outcomes and impact. CSALT, as part of the Link^ER team, has presented a methodology to enable projects to focus on outcomes from the earliest stages of their work. The emphasis here is on the effects which the project is having or has had on target and other audiences.

For further exploration of the range of different approaches to evaluation projects could be encouraged to visit the EFX Project Evaluation Toolkit which has been set up for the FAIR and X4L projects (at http://www.cerlim.ac.uk/projects/efx/index.html). (Notes on the above 'outcomes' methodology will also be found in the EFX Toolkit.)

Some projects have commissioned external evaluators to assist them or use their Steering Group to guide and advise. When this is the case, they report great value from their activities, and that an 'outside' viewpoint helps them to focus their thinking, especially upon their project outcomes.

[3] JISC Circular 7/02 item 21

1.4 Outcomes and deliverables

The JISC will expect outcomes and deliverables to be produced and delivered within the lifetime of the project.[4]

There is already evidence that detailed and demonstrable progress has been achieved, including prototype metadata schemas, demonstrators, toolkits and reports. Vendor products have been assessed and evaluated, and the findings shared.

A limited number of User Needs Analyses have been placed in the public arena, but it is difficult to elicit detailed common issues of importance from these, as they result from very different projects. In general terms, however, it can be noted that

- the user studies provided a wealth of ideas and suggestions beyond those already envisaged by the project teams, some of which may be carried forward for development beyond the lifetime of the DiVLE projects.
- they have the potential to inform technical, pedagogical and institutional policy and decision making. They may have implications for institutional change, new or better procedures and processes, reallocation of funding, or new job roles.
- they may inform other JISC resource providers, services and programmes and suggest possible future projects.
- there is an emerging feeling that students as well as lecturers, administrators and librarians could usefully be considered as a 'user group' and that where appropriate, their interactions with tools and systems under development should be considered as part of routine user testing.

It is reported that conducting the user needs analyses has raised awareness of and interest in the projects, and placing prototypes and demonstrators in the public arena is therefore to be encouraged.

[4] JISC Circular 7/02 item 23

1.5 Project Dissemination

… projects will be expected to engage in project-specific dissemination to the HE and FE sectors as appropriate[5]

The range and volume of dissemination activities recorded after only five months of project work is striking. Project websites cross-referenced to the JISC DiVLE web pages have been set up, and these already contain a wealth of resources which may be of value to other projects and to the wider community. One project is preparing an end of project webcast. Contributions have been made to around twenty seminars and a similar number of conference submissions are listed. These cross both the library and teaching and learning communities. At least seven publications have been submitted to academic journals, some of which have already been accepted for publication.

It is unclear from the list of dissemination activities how many of these capture the FE sector, and few are specifically targeted there. It may be that projects are simply relying upon familiar HE outlets for their dissemination activities, or perhaps are less aware of appropriate fora through which to disseminate their work to Further Education.

2. Environmental issues

2.1 Contact with the wider community

It is encouraging that a number of projects report growing interest in the DiVLE programme. Publicity events within the projects' institutions have successfully raised awareness in the local community. In a wider arena, interest has followed conference presentations, and enquiries have been made where the project team already has an established reputation within this field.

Some have found it difficult to build new relationships by electronic means and have resorted to traditional methods - 'finding interested development teams has been slow. I am going to adopt a more mobile manner of working so that I can meet more people face to face to establish relationships'.

It is worth noting that this feeling is reflected within the programme itself where there are doubts on the efficacy of the DiVLE list as a forum for discussion and a call for

[5] JISC Circular 7/02 item 22

'internal' workshop type activity where ideas can be exchanged and face-to-face discussion fostered.

There are some good examples of new collaborations outside of the JISC community; with commercial companies developing similar products, with HERON, VLE providers, learning content providers, the IMS, LOM and OAI communities, ReadingListDirect, COLIS and the NHS library services.

3. Stakeholder issues

3.1 Project partners

The relationship between project partners has proved interesting. Some partners are only nominally involved in projects, others have a close working relationship with project team members. As some vendor products are also in the development stage, there is a feeling of 'learning together' in some partnerships and mutually beneficial arrangements are developing which may prove fruitful for the wider community. In two instances projects report that concentrated input from an expert partner for a period of only a couple of days has been instrumental in clarifying difficult issues and moving the project forward.

Inter-university partnerships are both long-standing and new, and some have revealed cultural differences which have required an 'adjustment in approach'. For example, in some institutions computing services are fully committed to experimental developments such as those proceeding in the 07/02 projects; in others they operate as services with a primary role of delivery to internal customers: the latter approach can create difficulties, for example with firewalls designed to prevent external access to learning systems or other development activities. More subtly, different institutions operate in markedly different ways – some, for example, being much more 'managerial' than others – and this creates tensions for joint development teams which may have to reconcile very different decision making processes (a problem exacerbated when relationships between universities/colleges and commercial firms are considered). A further issue is related to reporting lines and accountability: this is noticeable in 07/02 where many projects are building products which are designed for internal use: there is thus an 'experimental/developmental' reporting line to JISC (or at least to the Project Director) and a separate 'development of university services' reporting line to a Head of Service or Pro-Vice Chancellor. A final example occurs where the outcome of the project will be a new system or service which

impacts on staff workloads and responsibilities – it is one thing for staff to work flexibly to enable a concept to be proved, quite another to accept permanent changes to their jobs.

Of course the partnership with JISC is key, though some projects seem unsure about how their own and DiVLE activities will feed into future JISC strategy and would welcome clarification on this point. There are also anxieties about how their work might be carried forward after the end of the project.

3.2 Academics and students

Some interesting issues have arisen from work with academics as potential users and these are described in more detail in section 4, Teaching and Learning. Again there is a balance to be managed between different attitudes and priorities. For example, projects have identified different understandings in the library and academic communities of the purpose and management of reading / resource lists. While librarians use these lists to ensure that resources are provided for students and academics in a timely fashion, they speak of 'poor understanding among academic staff as to what the library does with submitted resource lists'. They note that some academics delegate responsibility for liaison with the library to academic staff who are also unclear how the library makes use of the lists. They make the point that that their need for sufficient notification to give them time to order new materials may not coincide with the 'traditional' view of the beginning of the academic year as the time to review and create resource lists. It is encouraging that some projects are exploring in more depth how and when academics actually compile and disseminate reading and resource lists to their students, both within and outside of their VLEs. They are fostering the idea that the resource list as managed by the library should be treated as an 'organic list that can alter and be updated throughout the year', and are providing tools, guidelines and advice to cultivate an on-going process which is simple for academics or administrative staff to use, yet which meets the needs of library staff. Such understanding of actual user behaviour and needs is essential to all projects if 'traditional' mindsets are to be removed; academics are only likely to engage with new procedures and processes if they can see their purpose and understand how they will benefit themselves and their students.

A further issue which impacts upon certain projects is the collection and management of metadata, especially where the tools being developed enable or require lecturers to place learning objects into a repository, or to link them to a library catalogue. This begs the question of who will create, provide and check the metadata for these objects, chase up missing data fields, maintain the data and generally 'do the housekeeping'. If responsibility for the process is given to the learning content or learning object creator, how can projects ensure that this will result in high quality metadata? Or should library or information specialists be given this task, and if so, have they sufficient understanding of educational content to enable effective retrieval by the teaching and learning community? The complexity of the metadata creation process for learning objects is not yet well understood, but it is currently being explored by CETIS who will be able to provide advice and guidance to the DiVLE projects. There are certainly implications here for new institutional processes, even new job roles, and it is not always clear that projects are considering the impact of these outcomes.

It is interesting to note that at least two projects intend to make the cost of resource provision more transparent to lecturers. One will do this by making 'institutional spend and item cost more apparent to lecturers' so that they 'gain an understanding of the … implications that this might have on institutional budgets', the other by the development of a 'third party copyright clearance facility' in conjunction with HERON. Other projects may like to consider whether they too would like to do this.

A number of projects have recognised the value of fostering support and interest at an early stage within their institution, and this is to be encouraged. There is evidence of outreach by means of presentations to staff, discussion groups, briefings sessions, formal staff meetings, and interviews for publication in in-house newsletters.

Finally, it is pleasing to note that, despite some reservations, academics have mostly reacted positively to the products being developed, and in some instances have suggested that they could be adapted for and offered to students also.

3.3 Accessibility for staff and students with disabilities

In keeping with the requirements of the Disability Discrimination Act and Human Rights legislation, and the wider access policies of the Funding Councils, it is expected that software and IT resources in institutions should be accessible to staff and students with disabilities.[6]

Several projects have been addressing accessibility issues from the outset, often drawing upon expertise within their institution, and there is mention of awareness of W3C, and WAI, of the use of standard style sheets and of JAWS or similar text reader software. However, three projects claim that accessibility is not relevant at this stage of product development, but will be taken on board during later dissemination activities. It is worth mentioning that while these accessibility issues should form an integral part of user testing of products and services, the issue of accessibility in a wider sense, for example in relation to the needs of off-campus students, should not be forgotten and may require particular attention.

It is also noteworthy that projects are already discovering vendor products which do not comply with accessibility standards. It is recommended that all such instances are recorded and that feedback to JISC and to the vendor on this point be encouraged.

3.4 Cross cultural communication

Finding a common language between technologists, educationalists, librarians, different departments in the same university and even members of a project board can prove difficult, as can understanding different professional standpoints and priorities. Many of the projects are dealing with multiple stakeholders, and have noted how this can have a significant impact on the development of the project. This problem identified within the project is likely to be mirrored and amplified in the different communities when the project has to present its outputs to different audiences, and needs to be given careful consideration.

4. Teaching and learning issues

The conclusion of the Link[ER] Project's review of developments, achievements and trends in the area of digital libraries and VLEs was that: *" It has been noted that the vast majority of published evidence suggests that initiatives to link libraries and VLEs*

[6] JISC Circular 7/02 item 31

come from the library perspective: there is little evidence that education practitioners, strategists or theoreticians have identified the issue as being of significance. This has resulted in a major gap and weak pedagogical underpinning of many initiatives that have taken place."[7]

Teaching and learning issues were also identified as important barriers by the INSPIRAL project. In particular the INSPIRAL project noted:

concerns about "spoon-feeding" students versus information overload concerns about online learning being an impoverished replacement to face-to-face learning concerns about facilitating different "learning styles"[8]

The comments on teaching and learning in this Report are grouped into three sub-sections that are informed by the idea that academic staff are key gatekeepers in relation to the activities of students. They deal with issues relevant to library staff and students directly but the focus here is directed primarily to the role of academic staff.

4.1 The use of resources by staff.

User needs analysis has identified academic staff as having already developed ways of finding materials.

" We were concerned by comments that were raised by some of the academic staff in our focus group. A small number of staff commented that the tool would be of limited use to them, as they already know which resources they are going to put on a module resource list as they have a list of 'favourite' sites. We were surprised by this viewpoint, which seems to indicate that module lists are not reviewed and updated on a regular basis to take account of new content."

This evidence would accord with findings made during the EDNER evaluation of the DNER which found that academic staff were most likely to use Google for desktop searching. Searching for new materials was often managed through informal networks, through colleagues, conferences and printed or electronic circulars that alerted them to new materials. It is noted that searching through the RDN for teaching materials is rare and this finding is also in agreement with earlier findings by EDNER. It will be important for projects trying to link digital libraries with VLEs to have a good awareness of the current practices of academic staff. For there to be successful deployment of new technology the projects will need to ensure that either

[7] Link^ER Deliverable D1 p 40
[8] INSPIRAL Final Report 5.2.4

the new arrangements conform to current practice or that sufficient attention is paid to the changing of current practice in ways that will assist the deployment of project outputs.

The user needs analysis conducted by one project recommended that Google should be included as a search target but only as an optional search facility. The focus group they held with academic staff recorded that a majority of participants were doubtful about the inclusion of Google on the grounds that searching through Google can provide a large number of results of low perceived quality. On the other hand the project also recorded that academics use Google as their primary source of information and that although academics seemed to have a high level of awareness of the RDN only 30% made use of it for teaching. Another example of a user needs analysis resulted in a list of institutional recommendations that had the intention of feeding into a review of procedures to support changes in current practice. It also reported the current student practices of reading on screen to avoid printing costs. This finding led directly to a recommendation to improve the quality of readings for on-screen display.

It is also noted that divergent pedagogic practices can mean a significant refocusing is necessary to ensure the transfer of project outputs from one University to another.

"Differences in the delivery of teaching at the University of X, where courses are not modularised, and direct access to the teaching time by anyone other than tutors is not the norm, has meant that some aspects of the transfer of the project methodology to X is requiring a different approach"

The outputs of projects will need to be developed with an eye to how they might need to be adapted in other environments if they are to be successfully transferred. It is notable that many of the DiVLE projects do not have a clear focus on the academic staff who are likely to use the project outputs. It will be important in the final months of the projects to develop in this area.

We recommend that all projects review their current understanding of the academic staff who are likely to make use of the project outputs and ensure that they have a clear strategy in place for enrolling academic staff to ensure that the outputs are taken up and that staff have clear incentives to make the outputs sustainable benefits. An example of this approach can be found in one project that made use of initial interviews for the user needs analysis to promote bursaries that were designed to support online course development using the project's concepts.

4.2 VLEs and Distance Learning

The INSPIRAL Final Report noted that campus based face-to-face teaching would need to apply digital libraries and VLEs in such a way that they would enhance teaching and that distance learning would need to be supported in ways that would not disadvantage the distance students. The linking of digital libraries with VLEs is central to that vision and some projects are finding that the different ways distance and place-based students relate to VLEs affects the way in which resources are provided.

One project has as one of its central aims the integration of distance students into a full provision of library services. As part of that provision the project is developing a set of information skills units for use by place-based as well as distance students. These units were originally to have been authored within the VLE but the project found that only distance learners actively use the VLE. Campus-based students do not necessarily log into the VLE. The different student behaviour of place-based to distance students has meant that it was more useful to locate the material outside the VLE even though distance students can still access it from within the VLE. This minor project revision draws attention to a significant issue that all projects might need to consider. The integration of digital libraries with VLEs will potentially bring together different student bodies with quite different ways of relating to both the VLE and to library services.

Other problems have been uncovered for some students in relation to their VLE. It has become apparent that some student resistance to the VLE is based on the particular features of the VLE. This is not only in relation to the VLE as a general type but also in relation to the features of the particular version of the VLE.

In one case a student cohort was found to be still having difficulties with the VLE after several months' use, manifesting itself in less than optimum use of the system. Evaluation work was still in progress, but it was suspected that this lower use was because the VLE environment was less flexible than it could be and did not allow effective cross-linking. This meant that students' expectations of easy access to resources were not met, and they had to spend a substantial amount of time going up and down hierarchies to access material. This in turn was the result of their earlier choice of VLE - a more expensive version of the software concerned should support more extensive cross-linking.

The interplay between different student bodies, the choice of VLE and even the particular version of VLE presents a potentially complex problem for projects that wish to ensure that their project outputs have a more general application. Projects cannot consider every eventuality but they will need to be sensitive to the way their project outputs may need to be carefully adapted to meet other teaching and learning contexts

4.3 Other stakeholders

The question of different stakeholders is not simply one of language and projects have encountered different interests within host institutions. For example one project noted:

"The University Library has an existing relationship with a commercial software company called Sentient, who are developing an electronic reading list product called 'Reading List Direct'. The Library has been piloting this product since early 2002 for the creation and management of electronic reading lists. The product seems to be developing some functionality, which is along similar lines to the … project. In particular, Sentient is now offering an 'RDN integration module', although we haven't seen this in operation at this stage, and we have limited information about what this will provide. It may be that there will be some overlap with the work that we are undertaking."

We note this not to draw attention to the organisational questions this raises but to point towards another question that projects will need to address as they move towards dissemination of project outputs. The shifting pattern of provision in the entire institution will present itself to academic staff. They will not be concerned with the political, organisational and technological issues that lie behind the situation but they are likely to be hesitant in the way they approach new initiatives if they cannot see a single stable solution to the problems they identify for their teaching and learning. This raises the question as to how projects can present their work as a component of the institutional e-learning strategy – a requirement for a coherent and compelling institutional vision.

5. Technical issues

At the half-way stage of the projects there are, not unexpectedly, a considerable number of technical issues which are starting to emerge, or whose importance is being confirmed as projects develop their products and approaches. The following headings summarise these:

5.1. Resource Description

Not unexpectedly there are a range of issues arising from the attempt to integrate 'library' and 'learning' objects. These may be summarised as:

- The need to map 'library' standards/schema (MARC, DC etc.) with 'learning' approaches (IMS, LOM, SCORM etc.). There is of course a considerable amount of international effort in this field, going well beyond the DiVLE programme. As yet there is a lack of consensus across UK FE/HE on the preferred approach.
- Problems of semantic interoperability even where it is possible to map fields between schema. Mapping between vocabularies is thus a significant issue (as it is in other fora).
- Lack of support for some requirements which arise at the learning environment / digital library boundary, of which reading lists are the most obvious example. Thus library management systems support item level descriptions but may not support embedded annotations, course coding etc. which are sharable across the Digital Library / VLE interface. There is also an important issue in this area related to version control, since academic practice may be one of 'continuous updating', thereby creating dynamic rather than static objects.
- The use of multiple metadata schemas to describe objects (and multiple controlled vocabularies) creates problems. It is likely that these will be needed to provide different 'views' on each object dependent on different purposes / audiences.

5.2 OpenURLs

This is becoming a key technology to provide persistent links, and a number of projects are providing useful demonstrators. Generating learning object OpenURLs is shown to be feasible by at least one project but we are unsure yet of the generic solution – a 'LOM-OpenURL' community is however developing. Other projects are looking to test out various aspects (including, for example, multimedia, lecture notes and exam papers) later in the programme (or may offer them as recommendations for future work). It is noted that the NISO OpenURL standard (version 1.0) has just been released for public comment and will shortly enter the testing phase.

5.3 Embedding third party services

There are issues around the ways in which 'library' services such as HERON can be embedded in the VLE. (The HERON example is interesting because of copyright clearance issues, but the issue is more generic and relates to a variety of potential services.) For instance, it is still common for some services to be restricted by university IP address rather than, for example, Athens enabled so that off-campus access is not enabled. Where services are (relatively) standalone this can be made clear to users but it is more difficult to handle this cleanly once they are embedded in the VLE. At the object level, it appears that while some publishers are happy to grant permission for, say, an image to be used in classroom teaching they are not happy to allow it to be delivered in a VLE, regarding this as 're-publishing'. If this cannot be handled seamlessly (from academic staff and student viewpoints) it could undermine the use of VLEs.

5.4 Openness of VLE platforms

Although projects are not reporting major difficulties there remain questions as to how open the VLE platforms are and thus the degree of customisation and interoperability that can be achieved or should be attempted. The first question relates to the feasibility of customizing the VLE; the second to the desirability, long-term, of so doing. Certainly, experience suggests that the major VLEs (WebCT, Blackboard) are more 'open' than in the past and there is now a developing body of experience of developing, for example, open source plug-ins (as, for example, in the Blackboard Building Blocks community). However, it is one thing to develop additional features and to customize a commercial product within an experimental setting. It is quite another to demonstrate the sustainability of this approach. Previous experience (for example with library management systems) suggests that local

customization can come unstuck when commercial suppliers roll out major upgrades to their products. Further, institutions need to be very sure that they can support the maintenance load that local customization imposes. This may also raise questions of how scalable across HE/FE solutions developed in projects actually are, particularly if 'local' solutions have to be adopted. Again, to give an example, customizations are rarely as broadly tested against different product versions as their commercial equivalents. (It may be noted that these issues will in part be considered through JISC's introduction of a central source of open source expertise.)

5.5 Cross-searching

A number of familiar problems with cross searching are being reiterated. These include:

- The shallow nature of much cross-searching, and the related problem that access to native interfaces may be needed for deep searching of a particular resource.
- Differential response times from different resources. This means that results cannot be presented reliably until the slowest target has completed, especially if the intention is to concatenate and process result sets.
- The ranking of result sets is problematic even when the full set is available since the end-user may not define ranking criteria in the same way as developers or targets.
- Removal of duplicates is non-trivial.
- Problems of semantic interoperability, even where common schema are being used (and interpreted in the same way). There is considerable scope for confusion where there is no common agreement or approach to vocabulary control.
- While there is considerable experience of cross-searching, cross-browsing is less well understood.

5.6 Access management

Authentication and authorisation requirements are being explored but the solutions/ development paths need further clarification e.g. limitations of Athens, Shibboleth, SSO. There is a need to pay attention to the integration of personalisation functions across VLE/DL.

5.7 Non-standard resource types

An issue has been identified in providing resource linking where objects are not in standard (web accessible) formats and some further exploration is needed of this issue. Examples would include some executables or audio files requiring a 'wrapper' or some other files requiring synchronization. Again, this issue has relevance well beyond the immediate aims of the DiVLE Programme and it would be useful for projects to record instances.

6. Conclusion

It is encouraging that in a programme of such short duration so many issues of interest and importance are already surfacing. Some of what has been learned so far needs to be acted upon within the lifetime of the programme. Other issues may contribute to future projects and programmes. It is gratifying that the nine DiVLE projects are so willing to share what they have learned, and the Link[ER] team is indebted to them for their co-operation, frankness and support.