Learning from difference: GITTA and e-MapScholar – contrasting experiences in developing e-learning for GIScience

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Abstract

There remains considerable interest in the development and effective use of e-learning materials as part of the educational experience. The spectrum of stakeholders includes government (outreach strategies and lifelong learning), commercial developers, academic and virtual institutions, teachers and students. As technical and pedagogic issues are addressed, so attention is turning to methods of sharing material (pan European and globally), and ways of facilitating the customisation process by which material can be tailored according to student ability; course structure; content and associated activities; and localisation of material according to geographic regions familiar to the student. This paper presents two e-learning projects (undertaken independently of one another), e-MapScholar and the GITTA project, and examines their similarities and differences, before drawing a set of lessons which have broader application in the development of shared e-learning materials.

Introduction

A multitude of e-learning projects in GIScience have been funded across Europe and beyond over the last decade. From the initial expectation that e-learning would provide a means for funding agencies to reduce costs a more realistic realisation of the high cost of quality e-learning material and its positioning within traditional Higher Education (HE) curricula has developed. High costs lead in turn to stronger demands from funding agencies for guarantees of future maintenance and use of materials from funding agencies. For example, the Swiss Virtual Campus (SVC) explicitly requires that materials developed through its funding mechanisms are used in teaching by project partners. Equally, the Joint Information Systems Committee (JISC) in the UK has funded a project called Jorum with the aims of investigating user requirements for a *national repository service* and supporting a research programme into *reuse of learning materials*. The latter is investigating the issue of ongoing maintenance and sustainability of learning materials once 'published' (www.jorum.ac.uk).

Within Europe initiatives to jointly develop resources to be used across national, linguistic and pedagogic borders include UniGIS (www.unigis.org) which provides access to modular materials suitable for use in distance learning courses with 'local' support. These materials are provided to registered students at institutions which are responsible both for the awarding of a degree and revenue generation within the UniGIS network. The NCGIA core curriculum (www.ncgia.ucsb.edu/giscc/) provides an example of the development of a set of learning materials by a diverse set of academics within the US which are freely available over the internet. Indeed, the NCGIA provides one of the most common examples of shared use of materials. Web searches reveal many examples of the acknowledged use of NCGIA materials in online lecture materials provided by individual academics. However, this 'sharing' is a one to many relationship, with no mechanism for the flow of ideas or examples back into NCGIA materials.

A shared vision amongst many GIScience educators is to provide mechanisms for the sharing and development of materials *within* e-learning initiatives and furthermore, for the development of mechanisms to facilitate sharing of materials *between* initiatives. However, even a cursory examination of e-learning projects reveals a wide variety of different styles and approaches to the delivery and presentation of materials to students. These styles reflect, amongst other issues, differing pedagogical approaches, target audiences, funding constraints and underlying motivations. Here we consider two contrasting e-learning projects in GIScience and use them as exemplars to consider some of the issues which confront us when we set out to consider strategies for the sharing of e-learning materials.

GITTA (Weibel and Lorup 2003; www.gitta.info) is an SVC funded project which involves eleven departments from seven Swiss HE institutions involved in the teaching of GIScience in Switzerland. Between them these seven institutions account for some 75% of the teaching effort in GIScience in HE in Switzerland. The project partners are interdisciplinary, ranging from geographers to geomatics engineers, forest engineers and environmental scientists but all teach core GIScience courses. The GITTA project aims to develop a comprehensive pool of learning materials for such core GIScience courses at basic and intermediate levels which closely match the teaching curricula of the participating institutions.

e-MapScholar is a JISC funded project managed by the EDINA national data centre (www.edina.ac.uk) and involving a number of academic partners. In contrast to GITTA, the project aims to develop a specific set of materials to illustrate the use of geo-spatial data currently available within UK tertiary education including digital map data available from the EDINA Digimap service (Purves et al., 2002; Reid et al, 2004). The Digimap service, which is operated by EDINA, provides access to National Mapping Agency data (in this case from the Ordnance Survey) to over eighty UK Higher Education Institutions. Users of these data come from a wide range of disciplinary backgrounds, often with a limited tradition both in the use of spatial data and teaching in its use. Thus the e-MapScholar project aims to support learners through the provision of a range of materials that develop skills in the use of digital map data and knowledge of geo-spatial concepts specific to a variety of disciplinary backgrounds – not just the geosciences. The aim of the project is not to teach students about GIS functionality, but rather about key concepts in utilising spatial data with examples contextually relevant to their particular discipline.

In this paper we first explore some of the similarities and differences between e-MapScholar and GITTA. Impediments and opportunities for the sharing of materials are explored through the mapping of a GITTA lesson to e-MapScholar and its integration therein. Finally, a set of lessons for consideration in the development of e-learning materials in GIScience and their shared use are considered.

Comparative discussion of GITTA and e-MapScholar

Project background

The GITTA project is one of about fifty projects funded by the (Swiss Virtual Campus) (SVC) (www.virtualcampus.ch) in 2000 as part of a programme to develop e-learning within Swiss universities. A stated purpose of SVC projects is to "integrate e-learning into every day teaching" for use with undergraduate students, in other words to be used in conjunction with traditional methods of teaching (blended learning), and not for students undertaking distance learning courses. SVC funding is matched, with participating universities contributing 50% of the overall funding. The SVC further sought to encourage development of materials with a broad-based appeal by stipulating that any project must have a minimum of three separate universities as partners. The SVC also requires that partners guarantee that developed materials be integrated into existing curricula. As described earlier, the GITTA project has a range of interdisciplinary partners all with a responsibility for delivering teaching in GIScience. The materials developed thus cover a broad range of core topics in GIScience, namely: data capture, spatial modelling, data management, spatial analysis, cartographic data presentation and GI Systems. Since these materials are mainly aimed at undergraduate students, they cover so-called basic and intermediate levels. The content of the courses was decided by the members of the consortium, with the key aim of being suitable for integration in individual offerings. Two forms of material were produced: *modules*, aimed to replace or complement traditional lectures and *case studies* designed to be used as practical exercises and focusing on developing students' problem solving skills.

The e-MapScholar project was funded as part of the JISC Learning and Teaching (5/99) programme (Bruce and Notary, 2004; http://www.jisc.ac.uk/index.cfm?name=programme_learning_teaching). One stated aim of this JISC call was to make data provided by the JISC more accessible in teaching. Thus the e-MapScholar project sought not to develop a GIScience curriculum but rather to develop a set of learning materials aimed at illustrating the use of geospatial data to a wide range students exposed to such data. Three types of resources were developed: *teaching case studies*, *interactive learning materials* and a *virtual work placement*. The teaching case studies were developed by members of the academic community as exemplars of the use of Digimap data. Workshops coupled with small financial inducements were used to encourage academics outside the consortium to submit case study material. The case studies enabled examples of good practice in teaching using geospatial data to be broadcast via the e-MapScholar project. The core elements of the learning materials were discussed at these workshops and three strands identified as being of widespread interest: *Working with Digital Map Data*; *Data Integration* and *Data Visualisation*. The *Virtual Work Placement* was designed to generate a real exercise mimicking the use of geospatial data in the workplace and is described in more detail in Pickering and Mackaness (2003).

Academic setting and pedagogical design

A key aim (and requirement) in GITTA was to produce materials suitable for incorporation in core curricula in GIS. Since GITTA materials were designed by partners from three of the linguistic regions in Switzerland (German, French and Italian speaking) and from a variety of different disciplinary backgrounds, GITTA delivers a pool of e-learning *modules* consisting of *lessons* that can be used to build tailor-made courses for use in specific, localised curricula in GIScience.

An initial decision was made to produce lessons in a variety of languages, but it quickly became apparent that the task of translating materials was a non-trivial one. Hence, rather than translating all materials to all target languages (German, French, Italian and English), translation was pursued in a 'on demand', delaying translation of materials until there was a request for use in a different language than the one used for original content development. Linguistic boundaries were also found to be pedagogic with contrasting teaching styles between, for example, the French and German speaking regions. In order to attempt to resolve these cultural differences (which include also different disciplinary requirements) teaching materials were developed according to a series of pedagogically-based guidelines to fit within modular components corresponding to themes in GIScience (e.g. Basic Spatial Analysis). Within these modules a series of lessons develop ideas (e.g. Terrain analysis) through a set of individual units (e.g. Geomorphometry). To maintain a coherent structure throughout the materials, irrespective of the context of use, the ECLASS scheme (adapted from Gerson, 2000) was adopted: Entry, Clarify, Look, Act, Share and Self-assess. In this scheme the learning objectives for a unit are set out in the Entry element, with multiple Clarify, Look and Act elements integrating explanation, illustration and interaction. The Share element aims to encourage discussion between students and the lecturer, whilst the Self-assess element allows the student to evaluate their progress with respect to the learning objectives (Figure 1).

Even within this framework, it was observed that there were significant differences in how the material was developed and structured – influenced along linguistic and disciplinary boundaries. For example, although lessons were nominally prescribed to require around two hours of self-study the length of individual lessons varies.

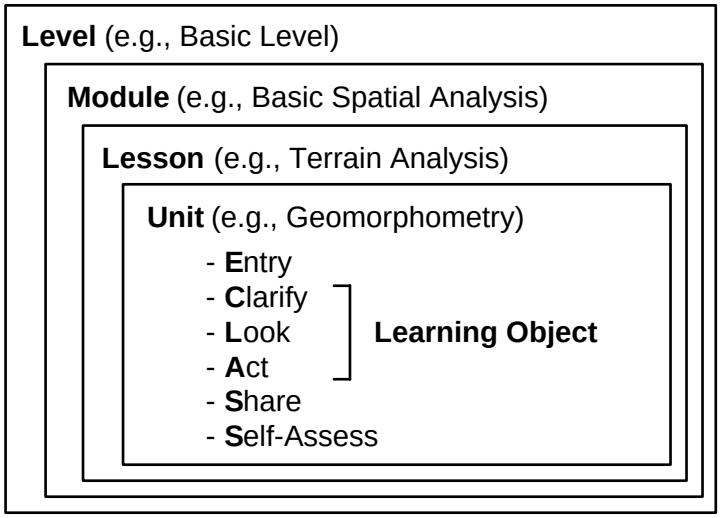

Figure 1: Hierarchical structure of learning materials in GITTA

Recall that in e-MapScholar the central aim was to produce materials, not for integration into curricula, but rather to be used to enhance the use of digital map data. The original intention was to produce a set of highly functional stand alone tools around which learning materials could be developed. However, consultation with lecturers identified three core requirements:

1) that methods for interaction, and specifically tools be embedded within the learning objects;
2) that a large set of learning objects suitable for customisation and reuse be developed; and
3) materials be localisable both to disciplinary and geographic contexts.

A key element in the design of e-MapScholar materials was therefore the development of a range of interactive tools. Learning materials in different themes were classified according to a similar scheme to that used in GITTA, consisting of *Learning Resources* (analogous to *Lessons*), *Learning Units* and *Learning Objects* (Figure 2). However, in contrast to GITTA strict rules (rather than guidelines) were imposed on the structure and composition of individual learning units by the involvement of an

independent evaluation team throughout the development of the learning materials. (discussed in more detail in the section describing Quality management of content).

A significant difference between e-MapScholar and GITTA was that in e-MapScholar the intention was to develop material specifically for the wider UK HE community. In GITTA, project partners guaranteed that they would use materials in their own teaching, and indeed the contribution of matched funding from individual host institutions further encouraged this. GITTA Consortium members also developed materials which were likely to be based on their current teaching, thus further facilitating the integration of materials into teaching. The e-MapScholar consortium attempted to enhance the likelihood of uptake of materials through a set of workshops for members of the UK HE community, and the use of the teaching case studies as described above.

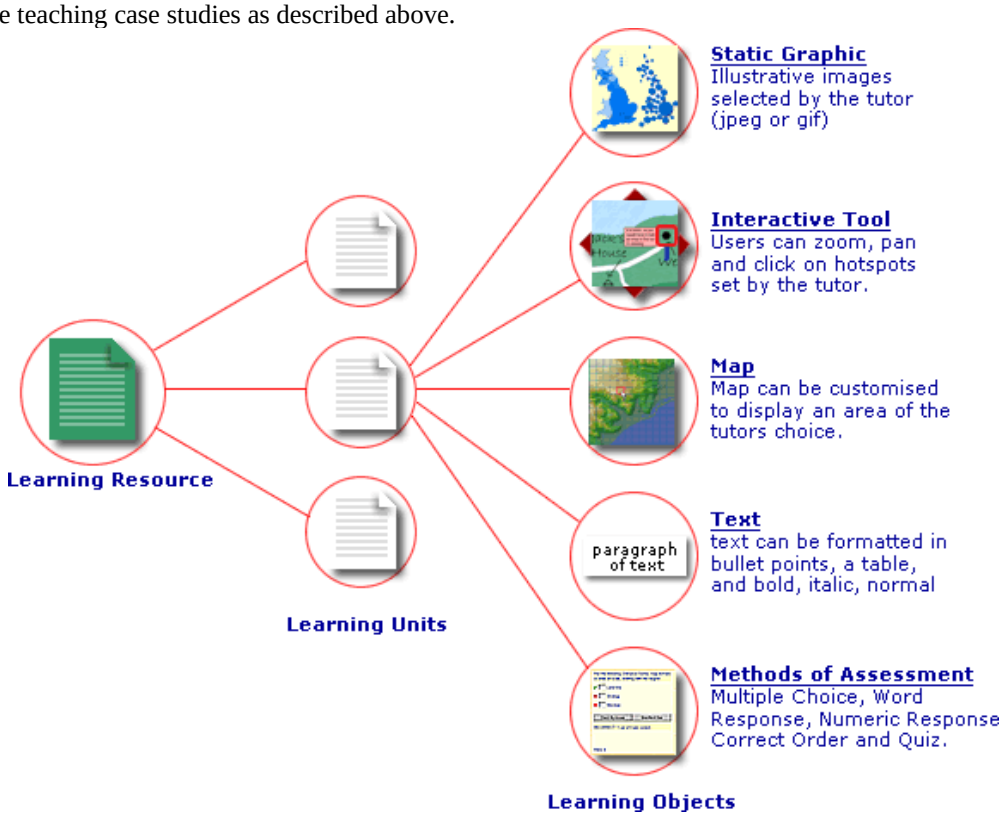

Figure 2: Structure of materials in e-MapScholar

Content delivery and presentation

Both e-MapScholar and GITTA materials are stored in XML, for a variety of reasons including:

- Sustainability of materials through use of a robust, platform independent standards.
- Use of templates (DTDs) to impose valid structures on materials (e.g. imposition of compulsory metadata elements, learning objectives etc).
- Separation of styling from content through use of style sheets and simple production of different output formats (e.g. HTML, PDF, RTF, etc.)

In the UK, accessibility considerations for web content have become a legal requirement through the Special Educational Needs and Disability Act 2001 (The Stationary Office, 2001; http://www.hmso.gov.uk/acts/acts2001/20010010.htm). Consideration of accessibility in the context of map data is challenging, but wherever possible the project team attempted to develop presentation of content which met current standards. The use of XML in both projects helps ensure maximum flexibility in presentation. Further requirements to improve accessibility can be addressed through updated stylesheets.

Interaction in GITTA is delivered via the use of Macromedia flash animations of which a large number have been created across all units. In e-MapScholar, tools allow interaction with spatial data through the use of the OpenGIS Consortium's implementation specifications (www.opengis.org) to interoperate with

a range of geospatial databases maintained by EDINA. The tools themselves are a mixture of Java applets and simple map requests with associated metadata (through use of, for example, the Web Map Server specification (Open GIS Consortium, 2001) Figure 3). The design of the tools in e-MapScholar focused on the importance of allowing customisation of tools. This in turn meant that development times have been much longer than those for tools in GITTA materials, where interaction was embedded within individual Flash animations and therefore not customisable (though this does not preclude reuse of GITTA animations in different units).

GITTA materials are delivered to the student through the use of a Virtual Learning Environment (VLE) platform (in this case WebCT (www.webct.com)) which manages and maintains links to content stored on a Cocoon server. Hence, Cocoon is the main content server while content is not directly integrated into WebCT as it is commonly the case in other e-learning projects using this VLE platform. WebCT further allows individual institutions to manage a sequence of links to lessons as well as managing course administration, facilitating electronic communication between students and teachers through e-mail and discussion boards and development of quizzes for progress monitoring.

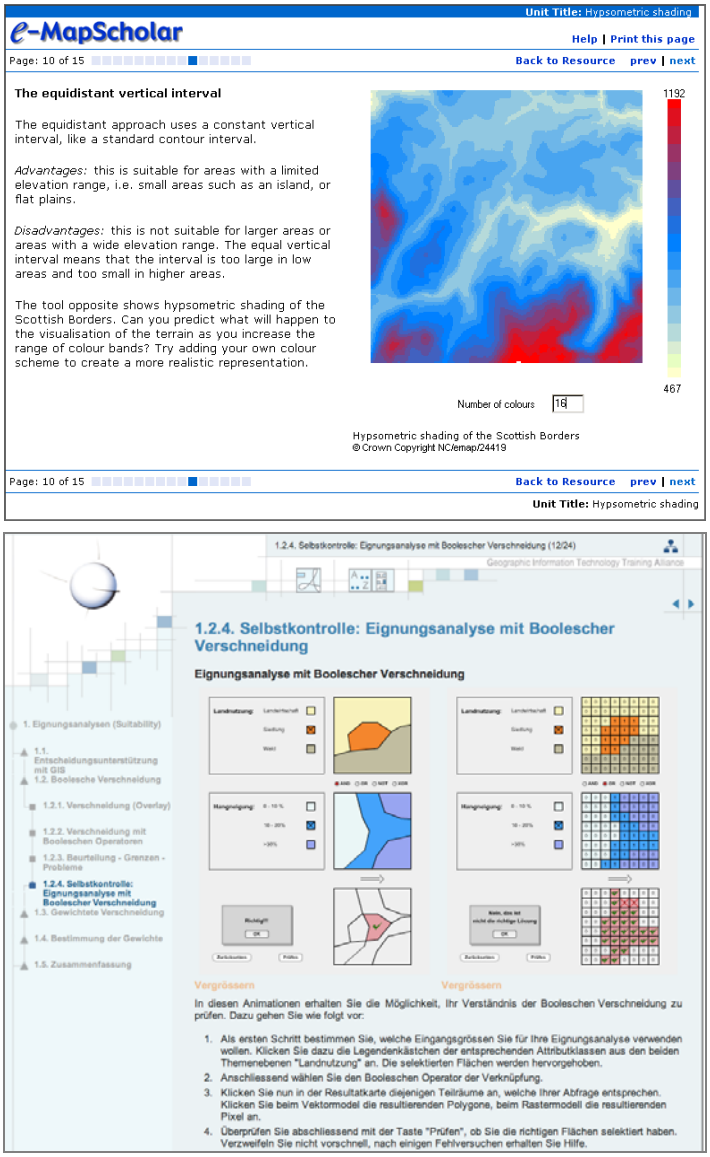

Figure 3: Example content from e-MapScholar (top) and GITTA bottom, showing integration of interactivity into learning object within individual learning unit

e-MapScholar materials have been delivered through development of an in-house content management system. This system was developed to allow users of e-MapScholar to customise materials (described further in the section on Creating, modifying and sharing materials) and because of the technical requirement to link to geospatial databases maintained by EDINA. However, this approach means that materials from e-MapScholar cannot easily be exported and stored in a standard Virtual Learning

Environment (VLE). To facilitate use of e-MapScholar materials within VLEs, a set of resource stubs are being developed which, for each resource, allow metadata and static views of the resource to be embedded within a VLE and permit links to be made to the resources themselves.

Creating, modifying and sharing materials

GITTA materials were created by individual consortium members, with creation of flash animations being delegated to specialist programmers. Content was developed using the ECLASS framework in a MS Word template, with conversion to XML generally being performed by technical specialists. Modification of materials in the case of GITTA required editing of the source XML, and as explained above, the main means of customisation was through assembly of different collections of material in WebCT.

As described above a key aim in the e-MapScholar project was producing a set of materials which were customisable by lecturers, both in terms of disciplinary and location specific context. These issues are discussed in some detail in Purves *et al.* (2003) in the context of interoperability. Learning materials were originally created by the consortium through the use of the DTD for Learning Resources and Learning Units. A Learning Resource can be considered to be basically a collection of Learning Units, with associated metadata and learning objectives (Figure 2). A number of options are available to teachers seeking to develop customised materials:

- new learning resources can be assembled from existing learning units, though creation of appropriate metadata and learning objectives; and
- learning units can be modified updating the text in individual learning objects, replacing images and modifying the behaviour of individual tools (for example by changing the geographical extent to cover an entirely different geographical region).

Discussion with potential users indicated that most customisation was likely to be relatively simple, for instance modifying an example to show data local to a student's course work and updating text accordingly. Lecturers were unlikely to engage with a complex DTD and XML editors to make such changes and therefore a simple form-based HTML editor has been developed to allow online modification of learning resources and units. An important consideration here was the appropriate updating of metadata with respect to modified units, in particular in tracking authorship of materials. The metadata model used in the project was based on the IMS Learning Resource Metadata Specification standard produced by the IMS Global Learning Consortium, though customisation of this model was necessary. Figure 4 shows editor screens for the e-MapScholar content presented in Figure 3.

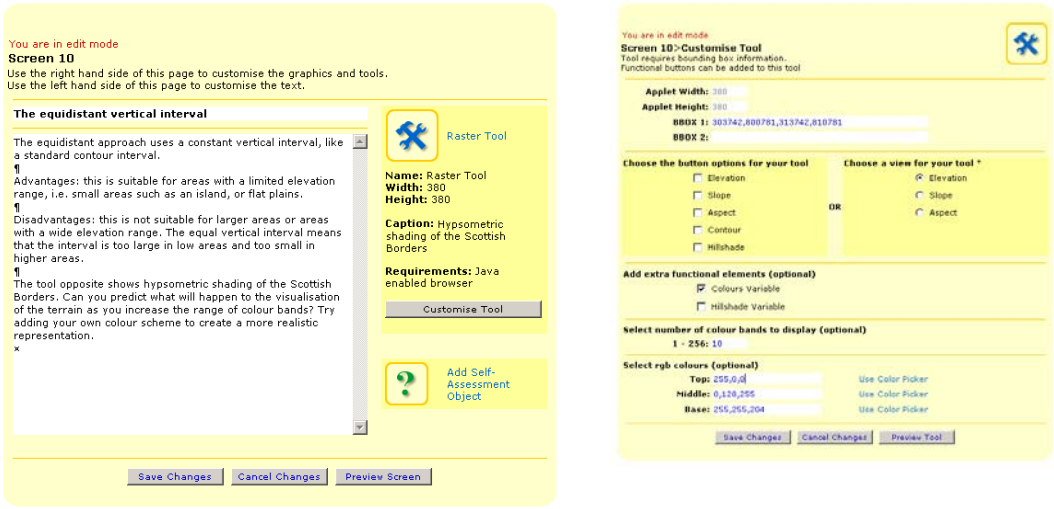

Figure 4: HTML tools allowing online editing of *Learning Objects* (text and tool) within a *Learning Unit* of e-MapScholar

Quality management of content

In the GITTA project an internal review process was provided by other members of the consortium. A review team, consisting of two authors, two teachers, and two students from other members provided

feedback to authors in Corrective Action Workshops. As a result of these reviews, weaknesses could be removed and sometimes significant parts of individual lessons and in some case entire modules were re-written. Due to delays in production as well as time constraints, some modules could not be subjected to a full Corrective Action Review. In such cases, the most comprehensive beta-testing was carried out during live use of the system by students. However, a pedagogic study of the influence of different modes of use of GITTA (namely 'pure' e-learning versus blended teaching) is in progress through observation of students using GITTA materials.

In e-MapScholar to ensure that the deliverables were pedagogically sound, a team based at the Open University (OU) evaluated the materials, tools and software directly with teachers and learners and fed back their findings to the developers and authors during the course of the project. Further subject specific evaluation was provided during the course of the project by a team of project advisors who were not responsible for content development. The educational evaluation of the teaching and learning resources is underpinned by the CIAO (Context, Interactions, Attitudes and Outcomes) evaluation framework (Jones et al, 1999; Scanlon et al, 2000). This framework has been used to evaluate courseware on a number of courses taught at a distance by the OU and focuses on both the effectiveness and quality of materials whilst simultaneously investigating the educational situation as a whole. Noteworthy is the fact that this framework requires observation of students interacting with the materials.

This form of evaluation was applied intensively to a small number of learning resources and the results discussed between evaluators and developers. Comprehensive changes to both content and presentation were required as a result of these evaluations, putting considerable pressure on developers. For example, a significant early criticism from evaluators concerned the limited range and use of tools for qualitative self assessment. This resulted in the development of a suite of tools for self assessment, which provided feedback to the learner as they made their responses. Thus resource development was iterative, with initial resources being modified considerably as a result of evaluation. A key result of the evaluation process was a concentration on the production of a small number of Learning Resources with very high levels of interactivity.

Finally, an internal review process checked text for typographic errors and quality managed finished units before their final submission to the content management system.

Funding mechanisms and future plans

Initial project funding of GITTA ended in June 2004. At this time a total of ten modules consisting of fifty lessons and nine case studies had been produced. Integration into the curricula of the participating partners started in 2003 and is still ongoing. However, since curriculum integration was a key condition for project funding, all partners are committed to continued use of the learning resources. Presently, access to GITTA content is restricted to students of consortium partners. However, the consortium is currently considering moves towards an Open Content policy. This will facilitate collaboration and integration with similar projects at the international level, such as e-MapScholar.

Although use of GITTA materials in actual courses has yielded encouraging feedback by students, further consolidation and improvements are needed. In terms of content, this relates to requests for enhancements by students as well as increased interactivity. With respect to technical infrastructure, content management by authors has to be improved and a move to a different e-learning platform that can fully integrate XML is also being considered. To that end, the GITTA consortium has received an extension grant from the SVC which will support maintenance and consolidation during the next two years.

The initial phase of e-MapScholar ended in 2003. Although, the technical case has been proven and the user community has expressed support and enthusiasm for the materials, the issue of the long-term viability of any service providing access to the materials through the content management system means that as far as development of new materials and tool are concerned the project is on hold. Crucially, the innovative use of web services to provide content in e-MapScholar means that content cannot simply be archived for future use but requires some minimal level of support.

Additional funding has been received from the JISC to conduct further evaluation and to investigate alternative business models for maintaining such a service. However, there are no existing subscription based services offered to UK Higher and Further Education and funded by the JISC which give access to learning materials and which therefore provide either some kind of precedent or business model. The whole issue of sustainability is bound up with questions about the economics of e-learning which the e-learning community is still grappling with – for instance the UK e-Universities programme has, as a result of disappointing uptake, recently been instructed by its main funding partner to place "greater emphasis on public good rather than commercial objectives" (http://www.hefce.ac.uk/news/hefce/2004/euni/), and is in the process of a major restructuring.

Mapping GITTA content to e-MapScholar: an example

As a result of a joint meeting between the e-MapScholar and GITTA teams it was decided that a worthwhile exercise would be to examine the feasibility of mapping content between the two projects. A lesson on terrain analysis was selected for mapping into the e-MapScholar learning resource centre. This exercise presented a number of challenges:

- The content was written in German, and the developer responsible for the mapping did not speak German.
- The content utilised Flash animations, which are not recognised by the e-MapScholar DTD.
- The content followed the ECLASS structure.
- The individual learning objects (the Clarify, Look, Act elements) were of widely differing lengths.

Interestingly, the developer encountered little difficulty in mapping from GITTA to e-MapScholar despite the language differences, as the DTDs proved to be relatively similar in style, and in particular the ECLASS structure facilitated the mapping process. The inclusion of Flash animations was also relatively straightforward and facilitated through inclusion of a new tool element in the e-MapScholar DTD. Thus the mapping proved much more technically simple than anticipated, at least from GITTA to e-MapScholar.

It is clear that the use of XML and associated DTDs facilitates technical interchange between e-learning projects, seen as a key aim by many educators in Europe. However, we would also argue that such technical interchange is the easy part of providing high quality e-learning materials suitable for use in a variety of institutional and cultural contexts. In the following section on *Lessons learnt* we consider the strengths and weaknesses of the e-MapScholar and GITTA projects before setting out what these lessons might mean for the sharing of materials.

Lessons learnt

Participation and outreach

The two projects varied in the nature and breadth of the participants. The GITTA consortium encompassed the majority of HE teaching in GIScience in Switzerland, and were thus empowered to develop a curriculum which *de facto* represents teaching requirements for GIScience in Switzerland. However, even within this representative group significant differences in teaching methods were observed across disciplinary and cultural boundaries (in this case mainly in the form of linguistic divides). Such differences point to the nature of the challenge in developing materials across the much more diverse background presented at a European scale.

The e-MapScholar project consisted of a small consortium, in particular with respect to the size of the HE community in the UK. The ambition of the team was to develop material for use by this much broader community, and to this end workshops, presentations and financial inducements were used to broaden the community of users as well as encourage the inward provision of materials. In attempting to accommodate the needs of a broad community with limited funding for the production of customised materials, it was necessary to build an infrastructure that allowed teachers to take quality assured materials and customise them themselves. This introduced a service element to the project. It remains to be seen whether a suitable business model can be found for long term delivery of this service and whether the broad cross-community use which has been demonstrated by the GITTA project can be encouraged in the UK by e-MapScholar.

Technical and Institutional Issues

The experiments in the transfer of content between projects highlighted the value of addressing issues of interoperability (for example in the use of XML and DTDs). The material benefited from being well structured (through the use of the ECLASS structure in the case of the GITTA project). The relatively simple structure of the GITTA materials meant that the exercise to transfer GITTA materials into the e-MapScholar framework was straightforward. Integrating e-MapScholar materials into GITTA presents much more challenging issues at both technical and institutional levels.

The innovative aspect of e-MapScholar is that the interactive tools dynamically access Ordnance Survey data which is held and managed remotely. The advantage of this approach is that the content of the interactive tools, e.g. the maps, can be localised. Another advantage is that, because interoperability is based on recognised standards, the tools can be linked to any standard compliant map or data server. A disadvantage is that the flexibility in customisation of e-MapScholar content restricts its portability as the

interactive tools are 'tied' to servers. In the case of Ordnance Survey data (and probably similarly for most European mapping agencies) there are also licensing conditions that reflect the commercial sensitivities of gaining access to the data. However, such issues are just one example of the institutional barriers, as well as broader national mapping policies covering access and economic benefit from national resources. Significant institutional challenges are presented by the sharing of content, where ownership of modified materials can quickly become ill-defined and issues of intellectual property rights (IPR) remain unresolved. These challenges apply in particular where materials are made not only openly available, but are modifiable. Again, however, this issue is not unique to e-MapScholar reflecting immaturity of thinking regarding re-use and repurposing of learning materials.

Evaluation

For both projects, the quality and structure of the content was paramount. Equally having the necessary resources to produce significant content leads to wider uptake and thus permits the material to be rolled out to end users for real testing. Each project had differing methods of evaluating the quality of content and delivery mechanisms. Though there was variation in the nature of that evaluation, it is clear that it is important to have in place evaluation methodologies that assess content, sequencing of material, methods of interaction and evaluation, and conformance to web design criteria (including issues of accessibility). In all cases, an iterative review and development of the system appears essential in both addressing the needs of a community of users, and ensuring precise dovetailing of material. A key lesson from GITTA was that the use of materials by students formed by far the most rigorous evaluation – dissatisfaction in the student body is generally quickly apparent! Adoption is a key issue in evaluating content – a consortium which itself guarantees use can move much more quickly to a position where large scale testing in real teaching is carried out. Equally, such a situation presents dangers where student dissatisfaction with 'beta' materials can lead to resistance of the continued use of such materials.

Adoption and funding issues

Government and educational establishments see enormous potential benefit arising from e-learning – in flexible and blended learning, provision of curricula in a variety of forms, media, and across different formats. Significant costs arise in both the development of material, and in provision of long-term service delivery. There is a reluctance to adopt and adapt e-learning materials where a guarantee of service delivery does not exist. The initial investment of effort (cost) in adapting course material to take advantage of e-learning, can only be realised over the long term delivery of that course. Precisely this dilemma has arisen in the context of the e-MapScholar project, where users are reluctant to experiment where long term delivery of service is not guaranteed. JISC, who funded the design and creation of content, would argue that it is for the user community (who are still to be persuaded of the value of e-learning) to pay for the delivery of this service. This is not unique to e-MapScholar, it reflects the general approach adopted by the JISC when it come to projects being converted into services. In the context of GITTA the commitment of the consortium, both in resources and development of tailored materials, guarantees adoption in the short term. The requirement of the SVC that partners guarantee that developed materials be integrated into existing curricula is also a significant 'stick'. However, the same long term issues of maintenance and updating of materials exist.

Flexibility of use

The materials developed by the GITTA consortium were designed for use by the consortium in its teaching. They cover a broad range of GIScience materials, and therefore are likely to be of use in other learning contexts, in a similar way to the materials developed by the NCGIA. However, whether this adoption could provide a means for maintaining and development of content – through for example, contributions of content or financing – is unclear.

The e-MapScholar project specifically set out to accommodate a broad community of users through the development of:

1) tools that allowed content to be customised both locally and contextually;
2) development of metadata models that tracked such customisation within a bespoke content management system; and
3) development of a set of user-friendly tools allowing such modifications to be made.

Such efforts may have considerable benefit over the longer term, each new module or tool taking advantage of previously developed material in order to develop a rich set of 'plug and play' material. However, while e-MapScholar has shown that it is technically possible to achieve the desired goals, given

the relatively short lifespan of the project, it was hard to demonstrate the value of this approach through adoption of the materials for use in learning.

Conclusions

The adoption of e-learning in teaching still requires considerable effort and resource through funding that supports development and maintenance of content, and strategies that ensure the uptake of materials by the community. The GITTA project demonstrates that an approach which integrates a large part of the community – probably only possible in a small country – can enjoy considerable success through the development of materials which match well to existing curricula and meet student expectations. Furthermore, matching of developers with those responsible for delivering materials increases the likelihood of adoption.

Development of materials for a wider audience, which necessitates sufficient flexibility for adoption across a range of disciplines and locations through mechanisms for customisation and localisation, is demonstrated by the e-MapScholar project. However, such an approach requires consideration not only of a strategy to develop materials in consultation with the community, but a model for encouraging the adoption of materials by the broader community. Such lessons are relevant for any attempts to develop materials across broader communities.

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References

Bruce, R. and Notary B., 2004, The JISC 5/99 Programme: What's in a number?, Ariadne, Issue 38, January 2004. http://www.ariadne.ac.uk/issue38/

Gerson, S.M.,2000, E-Class: Creating a Guide to Online Course Development for Distance Learning Faculty. Online Journal of Distance Learning Administration, Vol. III, No. IV (Winter 2000). Published by the Distributed Education Center, State University of West Georgia, http://www.westga.edu/~distance/ojdla/winter34/gerson34. html

Jones, A., Scanlon, E., Tosunoglu, C., Morris, E., Ross, S., Butcher, P., and Greenberg, J.,1999, Contexts for evaluating educational software, Interacting with Computers, 11, 499-516.

Open GIS Consortium, 2001, Web Map Service Implementation Specification , V.1.1.1, Editor: Jeff de La Beaujardière, OGC 01-068r2.

Pickering, A. and Mackaness, W.A., 2003, Virtual Placements in the context of e-learning: A Case Study in the use of Geographic Information in Proceedings of GISRUK 2003 11th Annual Conference J. Wood (ed), City University, April 9-11 2003. pp 260-267.

Purves, R.S., Medyckyj-Scott, D.J.M., Fairbairn, D., Mackaness, W.A., Robertson, L. and Wood, J., 2002, Bridging the gap - delivering customisable teaching materials to enhance utilisation of geographic data. In Proceedings of the GISRUK 10th Annual Conference, Sheffield, UK, pp. 40-44.

Purves, R.S., D.J. Medyckyj-Scott & W.A. Mackaness, 2003, The e-MapScholar Project – An example of interoperability in GIScience education. – In: Proceedings of the 6th AGILE, CD-ROM.

Reid, J., Higgins C., Medyckyj-Scott D., and Robson A., 2004, Spatial Data Infrastructures and Digital Libraries: Paths to Convergence, D-Lib Magazine, vol 10, no. 5, [Electronic Journal at http://www.dlib.org/]

Scanlon, E., Jones, A., Barnard, J., Thompson, J. and Calder, J., 2000, Evaluating information and communication technologies for learning. Educational Technology & Society 3(4)

The Stationery Office Limited, 2001, Special Educational Needs and Disability Act 2001, ISBN 0 10 541001 2.

Werner, M. and Stern, B., 2003, Active and Self-controlled Web Based Education in GIS Technology and Cartography: The GITTA Project. Proceedings of the 21st International Cartographic Conference, Durban (ZA), 10-16 August 2003, pp. 805-815, International Cartographic Association (ICA).

Weibel, R. and Lorup, E., 2003, Project GITTA: Building a Virtual Campus for Higher Education in Geographic Information Technology. Workshop on Optical 3-D Measurement Techniques, Zurich, 22-25 September 2003.