LSE Research Online

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Reuse, repurposing and learning design - lessons from the DART project

Article (Accepted version)
(Refereed)

http://eprints.lse.ac.uk

Abstract

DART (Digital Anthropological Resources for Teaching) is a major project examining ways in which the use of online learning activities and repositories can enhance the teaching of anthropology and, by extension, other disciplines. This paper reports on one strand of DART activity, the development of customisable learning activities that can be repurposed for use in multiple contexts. Three examples of these activities are described and, based on their use and reuse, some key lessons for the learning technology community are identified. In particular, it is argued that repurposing is a route to successful reuse, and that engaging the teacher in a participative design process is an essential part of the repurposing process.

Keywords: Authoring tools and methods; Media in education; Post-secondary education; Simulations; Teaching/learning strategies

1. Overview of the DART project

DART (i) is a major five-year project of Columbia University, New York and the London School of Economics, funded by a joint grant from the NSF and JISC[1]. It is examining ways in which web-based technologies and digital resources can be used to enhance student learning, particularly within the field of anthropology. Both Columbia and the LSE are seeking to enhance research-led teaching, developing ways in which students could come to know and understand the research process by direct engagement with researchers. The importance of this is now becoming increasingly recognised internationally by research-intensive universities (see, for example, Brew 2002).

The project acknowledged from the outset that in order to bring about the kind of changes that were desired it was not only a question of developing appropriate activities and resources, rather it involved re-examining the way in which teachers actually teach. At the heart of the project, therefore, was the employment of five post-doctoral research fellows in anthropology (two at Columbia, three at the LSE). Their role was to explore, with senior faculty, learning technology and library specialists, ways and approaches to teaching that seek to use the potential of online activities and resources to address fundamental issues in the teaching of anthropology.

While both partners are investigating the above issues, work at Columbia has been concentrating on digital library frameworks and issues of resource discovery (Dahlquist, Hoffman & Millman, 2005), whereas at LSE work has concentrated on the development of specific learning activities. A list of papers on DART, and reports on work to date, are available online (DART, ii).

This paper will concentrate on one aspect of that work, the development of reusable and repurposable learning activities, and some of the lessons learnt arising from that work.

1.1. Issues in teaching anthropology

A key feature of anthropology as an undergraduate discipline is that students are exposed to anthropological knowledge primarily through the reading of ethnographies. They themselves do not, as a rule, conduct ethnographic research and therefore have little opportunity to engage with the process through which anthropologists "produce" knowledge and arrive at conclusions. This issue is by no means unique to anthropology; versions of this problem, the distancing of learning from the process of knowledge production, are found across a wide range of disciplines, and within DART models and approaches are being developed that will have applicability beyond anthropology.

One way in which DART has addressed this question is through the restructuring of an introductory anthropology course so that it uses the fellows' research directly, as core "texts" to be studied. This is not in the conventional sense of items on a reading list, but rather as the content in a series of interactive learning activities. These activities seek to engage students in the process of ethnographic research and to highlight issues faced by the ethnographer in the field in ways that would not occur through reading classic ethnographic accounts. The "texts", as we will describe below, may include video or other media artefacts loaded into the repurposable learning activities.

2. Learning objects, learning activities, reuse and repurposing

2.1. Definitions of learning objects

Much has been written about learning objects, and definitions of the concept are often so general as to be meaningless. It is because of such difficulties with the term "learning object" that we prefer to refer to *learning activities*, while recognising that such activities may be seen by others as learning objects. We would view our learning activities more as "cognitive catalysts", in the sense used by Feldstein (2006):

> "I believe the term 'learning object' has become harmful. It hides the same old, bad lecture model behind a sexy buzz phrase. If we're really serious about stimulating learning, then we should think in terms of something like a cognitive catalyst. Rather than just serving up digital content and assuming the students will absorb it, we should be creating artifacts that function like enzymes for the intellectual digestive system ... To me, this is the essence of teaching. Cognitive catalysts can be learning content, learning activities or, most often, a fusion of the two."

2.2. Reuse and repurposing

By *reuse* we refer to using the activity or resource again in another context but with the same content, while *repurposing* refers to modifying the content or learning design. Repurposing can further be divided into (i) repurposing for reasons of localisation – e.g. translation to a different language, or minor changes to account for cultural differences, and (ii) repurposing to incorporate substantively new content – e.g. taking an activity used in an anthropology course, and adapting it for use in a language course.

Another dimension of repurposing lies in changing the way the resource is used, rather than changing the resource itself – i.e. changing the learning design. So, a learning object that is reused without any change to its content or function, yet is used

in a different way to that originally envisaged by its developer, has in a sense been repurposed. In our experience, this type of repurposing happens more often than not when a learning object is reused.

The reuse of learning objects is often associated with the potential for efficiencies. In the UK, the JISC-funded Jorum project has argued (Jorum, 2004):

> *"… the costs of developing LOs can be offset against the opportunities that appear in terms of sharing, customizing and re-purposing materials so that they can be used efficiently by a number of different people."*

Here the Jorum team refer explicitly to "repurposing", by which they appear to mean modification of the content of the objects (based on other uses of the term in their report). However, since the Jorum approach is very much about categorising learning objects into subject hierarchies, and as there is no requirement for learning objects in the repository to be easily modifiable, it would seem that the primary aim of Jorum is the sharing of fixed learning objects, to be used as they were created.

Our experience, together with other published evidence, suggests that this might not be the most effective path to successful reuse.

2.2.1. The reuse problem

It is clear that developers are enthusiastically creating reusable learning objects (RLOs) in ever-increasing numbers, and are sharing them by placing them into learning object repositories (LORs). The MERLOT repository, based at California State University (CSU), boasts 16,325 RLOs at the time of writing (MERLOT, 2007). However, there is little evidence yet that these RLOs are being picked up and used by teachers outside the original development teams.

MERLOT is the most prominent LOR at present, in terms of public awareness, number of RLOs uploaded and number of registered users. However, it is difficult to find evidence in the literature that MERLOT is being widely used by teachers. The "Measures of Success VIII" report (CSU, 2006) gives grounds for optimism, noting that, in 2004-2005 MERLOT contained 12,000 RLOs, of which 1,500-2,000 had been reviewed, which might suggest that at least those had seen some use. However, these figures are less encouraging in the light of Twigg's (2003) assertion:

> *"MERLOT cites "links to thousands of learning materials" as one of its benefits, yet only a tiny subset has been evaluated by anyone other than the contributors."*

Further doubt is cast on the reuse of MERLOT objects by Zemsky & Massy (2004), who accessed MERLOT every other month between June 2001 and January 2003. They conclude:

> *"Users continue to share what they have produced themselves without exhibiting much interest in rating or evaluating what others are offering. ... Indeed, if one follows MERLOT's postings as we did, one comes away with the feeling that there really are no e-learning consumers at all – only innovators and inventors eager to showcase what they have accomplished."*

The most thorough review of MERLOT usage (and indeed of any repository) we were able to obtain is that of Shea, McCall & Ozdogru (2006), who surveyed 710 online tutors at the State University of New York (SUNY) in 2004-2005. The subjects were taken from the SUNY Learning Network, which offers online courses and degree

programs, and represented 60% of the total teaching staff. Among such subjects one might expect a high level of awareness of LORs, and indeed 78% of them said they had "heard of MERLOT". However, only 17% had adopted MERLOT materials, of which 93% found them useful. This last figure is hardly surprising; teachers are unlikely to adopt materials that do not seem useful. Unfortunately the survey did not count subjects who had examined MERLOT materials but chosen not to adopt them. The survey did include a narrative item asking for reasons for not using MERLOT, but the results are not especially revealing: the most prevalent reasons identified were "simply chose not to use it" (26%), "time constraints" (24%) and "lack of relevant content" (18%). Also, it is not clear from the paper what the response rate was to this particular item.

2.2.2. Reasons for the problem

If it is indeed the case that teachers are not reusing the RLOs developed by others, what might be the reasons? RLO enthusiasts often assume that teachers would be using RLOs were they empowered to do so, so their reasons for low reuse often include lack of awareness of repositories, ineffective search facilities, the need for staff training, and lack of granularity. This last reason is part of the wider issue of *contextualisability*. As Koppi, Bogle & Lavitt (2004) point out:

> *"The more inherently contextual an object is, the less reusable it may be; something already loaded with context may be difficult or impossible to use in a new context."*

Granularity is often posited as the answer to this problem, as the smaller an RLO is, the more easily it can be used in new contexts. By the same token, however, the smaller the object, the less potent it becomes in terms of the learning objectives it can address, and the greater the number of them that need to be combined to make a meaningful contribution. Furthermore, as Tompsett (2005) has shown, as the number of RLOs required increases, the effort required to find suitable candidates and combine them into a larger learning activity grows disproportionately.

There is an important further reason for a lack of reuse, namely the lack of ownership that a teacher has when using learning objects developed elsewhere. This is often characterised pejoratively as "not invented here" syndrome, which, unfairly in our opinion, blames the teacher for the failure to adopt RLOs. We contend that it is only when a teacher is able to take ownership of a learning activity that it becomes meaningful in their local context and can be fully integrated with the rest of their teaching.

2.2.3. Repurposing as an alternative

However, making RLOs more granular is only one way of reducing or removing context. Another is to use learning objects that are themselves modifiable, so that they can be adapted for use in new contexts.

Gunn, Woodgate & O'Grady (2005) have argued that such 'repurposing' is the key to the reuse problem:

> *"...fully supported opportunities for teachers to 'repurpose' object structures through a participative design process is the path most likely to lead to the elusive goal of reuse of digital learning objects by a critical mass of teachers."*

The 'participative design process' is necessary, both to adapt the learning object(s) to its new context of use, and to involve the teacher in that recontextualisation. Evidently this requires commitment of time and effort from the teacher, so such an approach will not lead to financial savings. However, it is likely to have a greater positive impact on student learning.

In the case of the Gunn *et al.* case study, a period of intensive support was required from a technical developer, and they suggest that such support is a necessary part of the participative design process. However, as we demonstrate below, it is possible to design customisable learning activities that, although more onerous to develop in the first instance, can then be repurposed by other teachers with only limited technical support.

3. The DART development process

The DART learning activities were developed using the five-stage process shown in Table 1. It should be emphasised that, while this process is broadly sequential, the inputs from teachers identified in stage 1 are in practice continuous. They will be involved in the teaching in stage 2. They will be a key source of evaluation data (stage 3) and they will be heavily involved in discussions on modification (stage 4).

Table 1: The DART development model

Stage 1	Work with teachers to identify specific issues related to their teaching that online learning activities and resources may be able to address.
Stage 2	Develop a prototype activity and trial it with students as part of their course.
Stage 3	Evaluate the activity from both a technical and pedagogical perspective including student and faculty feedback.
Stage 4	Refine and modify the activity in the light of experiences and data from stage 3.
Stage 5	Develop a generalised version of the activity that will allow others to repurpose it and make it available to the wider educational community.

This approach is of course similar to that adopted on a range of projects. The SoURCE project (Software use, Reuse and Customization in Education) for example, adopted a similar model (SoURCE, i).

There are further, similar stages involved when the activity is repurposed for use elsewhere, in new teaching contexts and new subject areas (Table 2).

Table 2: The DART repurposing model

Stage 1	Teachers decide whether activity addresses specific teaching/learning problems on their course.
Stage 2	Teachers modify activity for use in new context, with help from original developers where required.
Stage 3	Apply new instance of activity to teaching/learning and feed back results to developers for further improvement of activity.
Stage 4	Evaluate activity in its new context and provide feedback to (i) teachers, in order to refine content, and (ii) developers, to allow refinement of the activity itself.

4. The DART learning activities

Here we describe three of the repurposable learning activities that were developed by the DART project. The activities are freely available to UK institutions via the project website and can also be made available outside the UK on request to the project team.
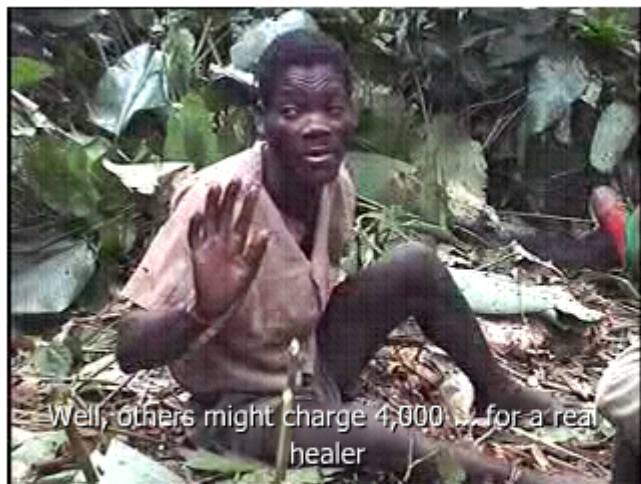
4.1. "What's Going On?"

The aim of *What's Going On?* (Figure 1) is to give students an experience of ethnographic fieldwork. The exercise presents the student with a video clip of an event involving a Pygmy hunter from Congo-Brazzaville. The video is enhanced by subtitles and by synchronised captions that provide links to additional information.

The student is given three chances to view the clip, at weekly intervals. With each successive viewing, the amount of complementary information, in the form of subtitles and captions, increases, simulating the increasing level of information available to a field worker over a period of several months. Students write an analysis at each stage, reinterpreting the scene each time with the benefit of more evidence, supplemented by what they have learned during the week in lectures and seminars. This allows students to experience the collection of ethnographic data, appreciate the ever-changing nature of anthropological knowledge, and challenge their subjectivity and cultural bias. They do this exercise at the same time as reading an ethnography about the subjects. The exercise therefore leads them to critically question how the ethnographer arrived at his conclusions.

Figure 1: What's Going On?

Level 3 of the activity as used at LSE. The links at the top right lead to documents providing more detailed information.

What's Going On? is a Flash movie which loads all its content from external files, based on the settings specified in a configuration file. All the data is stored as XML, and the video clip itself is converted to Flash. So, changing the content is a matter of editing the configuration file to point to a new piece of video, and creating new subtitle and caption files to accompany the new video.

To simplify this process we have developed an authoring tool (Figure 2) that allows a user to interactively add subtitles and captions to their own piece of video. Using this tool, the teacher can type subtitles and captions directly onto the screen, and export the XML thus created to be saved into a file. *What's Going On?* also provides a 'hotspot' feature that can be used to highlight areas of the video image which the user can click to obtain more information.

Figure 2: The subtitle authoring tool.

The teacher types the new subtitle directly onto the screen.
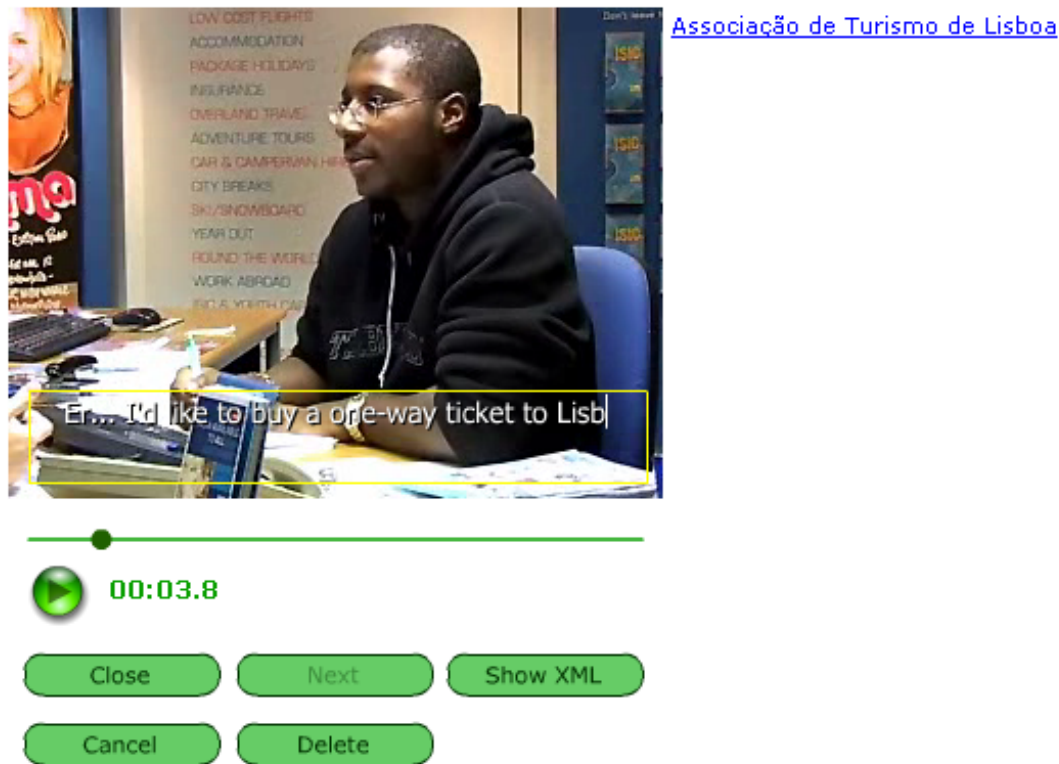
The repurposability of *What's Going On?* has been demonstrated through its use at the University of Waterloo, Ontario, Canada. In this case, while the basic student assessment tasks used at LSE were retained, the video content presented a different cultural group – the Chukchi reindeer herders from the Siberian Far East. In contrast to the dialogue that is the focus of the Pygmy video, the Chukchi version has little verbal information – in fact, the lack of conversation is an important ethnographic fact that students are expected to observe. The six-minute Chukchi clip concerns the celebration of a religious ritual associated with reindeer herding, and contains an enormous amount of visual data: students observe the Chukchi preparing new skin clothes, moving their skin house, lighting a ceremonial fire, rounding up the reindeer herd and sacrificially slaughtering two deer, painting human faces and effigies with reindeer blood, and drumming. The subtitles explain or describe specific actions in the video, while the captions contain background information relevant to events in the video and anthropological concepts that are useful in interpreting those events.

The Waterloo version of *What's Going On?* therefore not only differs in its content, but also adopts a subtly different approach. The activity has been taken into a new context, and used in a new way.

4.2. "Criterion"

Criterion allows students to understand a complex concept from the bottom up, by analysing real examples of the different aspects of the concept. It has been used by Anthropology of Cognition students at LSE to investigate the concept of *innateness*: i.e. the importance of biology, as opposed to environment, in human development.

Criterion is based on a grid (Figure 3) whose rows list phenomena that may or may not be 'innate,' and whose columns list potential criteria for innateness in the form of true/false questions. Students work as a group to fill in the grid, by deciding whether each criterion applies to each phenomenon and answering the corresponding question accordingly.

Figure 3: Criterion grid.

A completed grid showing students' mean assessments of truth or falsity.

Answer grid

	Present at birth?	Unchanging in development?	Does not vary across social groups?	Does not vary within social groups?	Shared with other closely related species?
1. Proprioception	Probably true	Probably false	Probably true	True	True
2. Depth perception	True	False	True	True	True
3. Facial hair	False	False	Probably true	Probably false	Probably false
4. Yawning	True	Probably true	Probably true	Probably true	True
5. Phoneme discrimination	True	False	False	True	Probably true
6. Eyebrow flash	Probably true	Probably false	Probably true	Probably false	Probably false
7. Sentence structure					
8. Theory of mind	Probably true	False	True	True	Probably false
9. Food preferences	True	False	True	Probably false	True
10. Maternal attachment	True	False	Probably false	False	True
11. Mama/Papa words	False	False	False	Probably false	False
12. Non-auditory linguistic communication	Probably true	False	Probably false	Probably true	Probably false

Each phenomenon is linked to a set of resources (multimedia, articles, websites, etc.) which students use, together with their course readings, to inform their decisions. *Criterion* averages the assessments of truth so that an overall choice emerges by consensus. Students also justify their choices by adding comments, which appear on the page for others to read (see Figure 4).

Figure 4: Criterion editing form.

On this page, students can decide whether the criterion applies to this phenomenon, and add comments.

The content of *Criterion* is stored in an open-source database so it can be completely replaced. Therefore it can be used to teach any complex topic that can be broken down in the same way as innateness. This activity has recently been repurposed for use on a course on the Anthropology of Kinship. The *Questions of Kinship* exercise uses *Criterion* in a simplified format, so that there is only one phenomenon (kinship), and a set of four questions:

- Is incest a universal taboo?

- Is blood thicker than water?

- Are gender and sex the same thing?

- Is kinship an issue in contemporary society?

Again, this provides an example of a repurposable activity being used in a different way from that originally envisaged. The flexibility of the activity lies not only in the fact that the content can be modified, but that this modifiability itself allows the activity to be used in new ways. An authoring tool for *Criterion* is in development at the time of writing, to allow teachers to easily replace the content with new phenomena and criteria.

4.3. "Explorer"

Explorer is an activity originally developed as *Kolkata Explorer* for a course on the Anthropology of India. This course aims to take students from the analysis of village life and the origins of the caste system, through to the modern, urban context. The aim of *Kolkata Explorer* is to give students an experience the process of collecting ethnographic data in an urban environment, and to challenge their skills in evaluating and discriminating between different data sources.

Using *Explorer* (Figure 5), students can explore the city of Kolkata (Calcutta), and visit a range of different locations where they will find resources that serve as evidence for their study. This evidence may consist of anything that can be put on a webpage – so there are texts written by the teacher, scholarly articles, external websites, images and video clips.

When a student finds a resource that is relevant to their study, they can add it to their personal portfolio, together with an annotation that explains its significance. This portfolio can be saved to a database, so the student can come back and retrieve their work later. Eventually they use their collection of annotated resources as the basis of a marked assignment.

At LSE, each student used *Explorer* to write a report about a "Day in the Life" of one of a range of composite characters living in the city. Later exercises required students to write short reports on specific topics of urban anthropology, using *Explorer* as a source of evidence.

Figure 5: Kolkata Explorer.

The large-scale map view, with a location indicated.
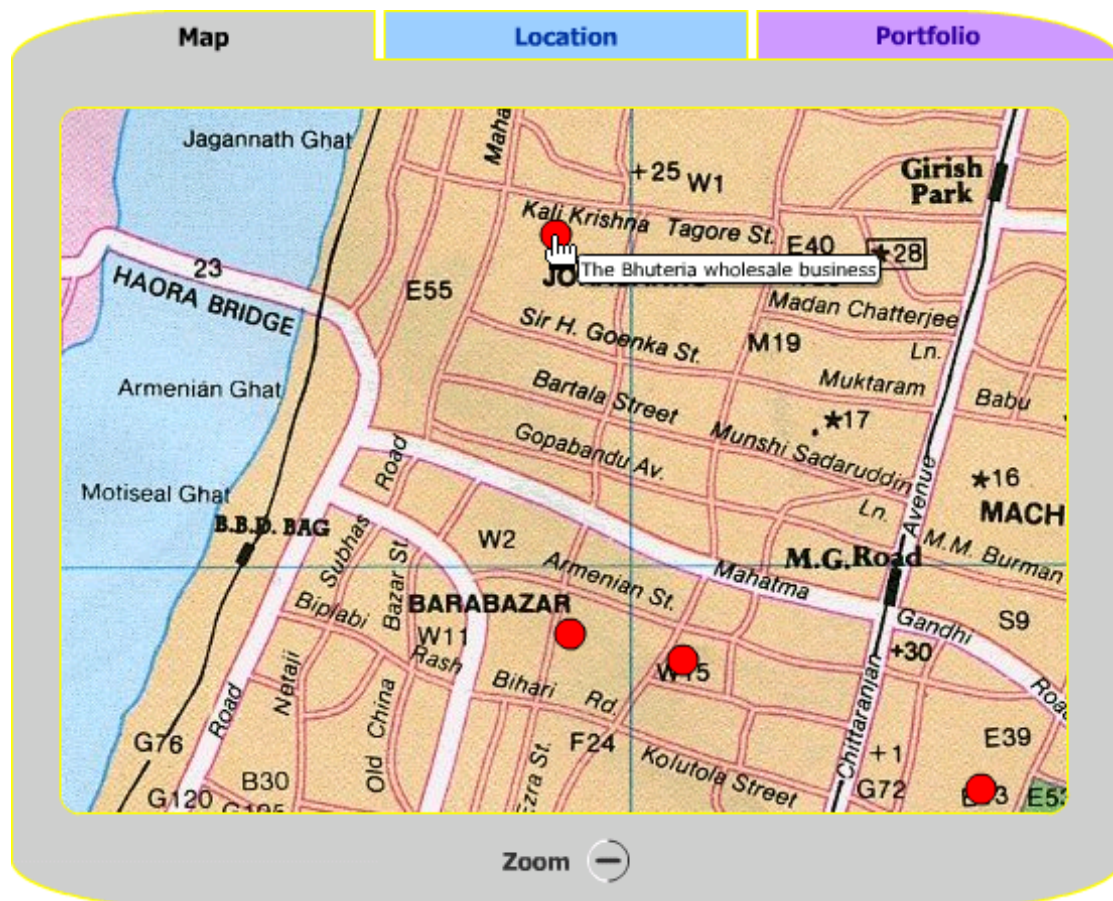
Explorer is a Flash movie that pulls in its content from external files – JPGs for the maps, and XML for configuration, the locations and the links. Also, there is a link to an open-source database to allow students to save their work between sessions.

So, once again, the activity is completely customisable in terms of content and can be reused for teaching different subjects. The images could be anything, not necessarily maps; one might replace them with a photo of a geological formation, or an anatomical diagram.

Kolkata Explorer has been reused in its unmodified form at Olin College in the US. However, here the activity was used in a subtly different way. Whereas at LSE each student worked individually, at Olin the students worked in pairs to complete the "Day in the Life" exercise, and then presented their work in a seminar format, using the activity as a presentational device. So, here we have an example of a learning object being reused with unmodified content, but with a modified learning design.

Recent efforts to develop an authoring system for *Explorer* have led to the development of an alternative version in which it is the students, rather than the teacher, that populate the map with resources. The new version is the *Spitalfields Explorer* (Figure 6), which is awaiting its first use by students at the time of writing.

Figure 6: Spitalfields Explorer.

Showing the map editor interface, with a user-added location shown. Note the editing controls on the bottom bar.
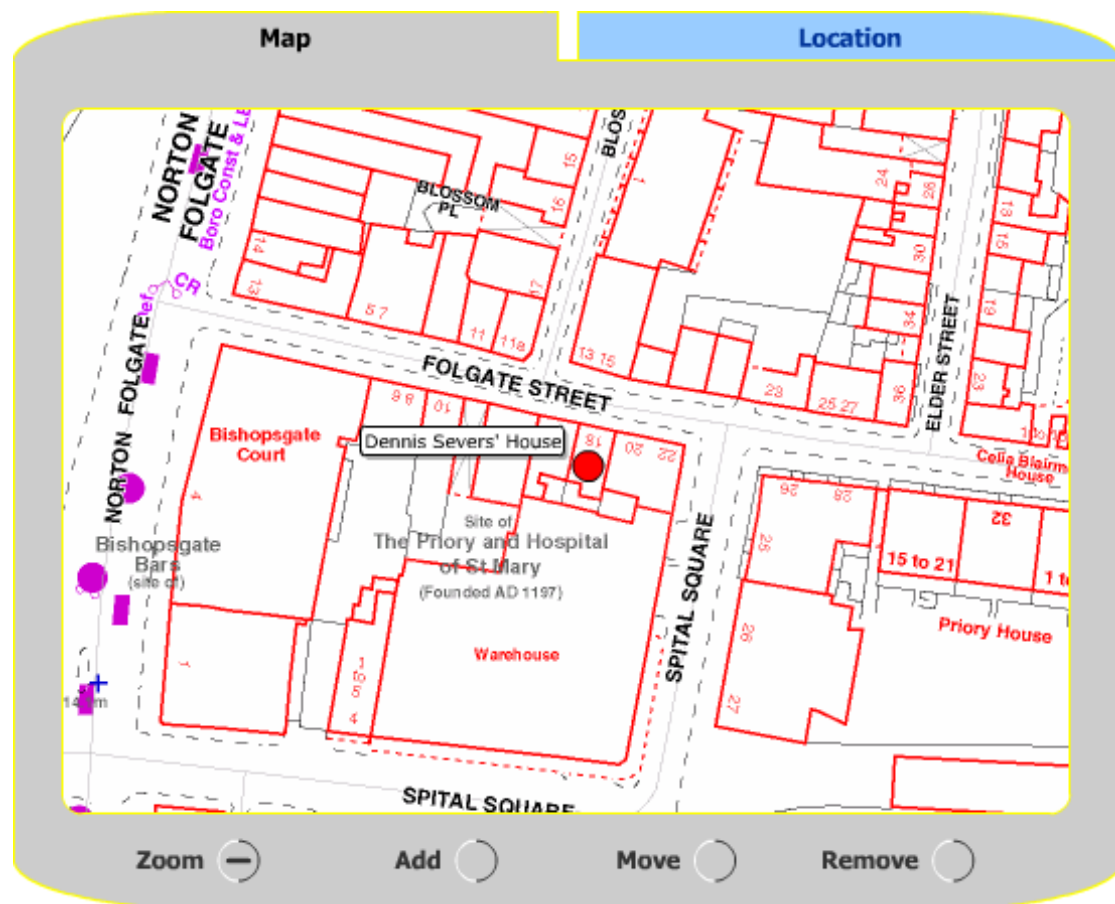
5. Some lessons learnt in relation to reuse and repurposing

We are still in the early stages of supporting the repurposing of DART learning activities; nevertheless, some lessons have emerged that are of relevance to the educational community. We elaborate on some of the findings below.

It should be emphasised that the context of use has been mainly in research-led teaching, supporting the development of higher-order cognitive processes. Our observations therefore may not apply in different educational contexts where the emphasis may be on mastery of a given body of knowledge, rather than the development of critical analytic and synthetic skills.

5.1. Repurposing and the reuse problem

The examples above show the potential for customisable learning activities to solve the "reuse problem". The DART activities can be adapted for use in a wide range of contexts, and the process of adaptation itself leads to the teacher engagement that is necessary for the activity to truly become integrated into the teaching. The provision of intuitive authoring tools reduces the need for technical support so that teachers can concentrate on the pedagogy. Our findings show that such repurposable activities can be readily and successfully transferred to new teaching contexts.

Similar findings are reported from the SoURCE project by Laurillard & McAndrew (2003), where a learning activity originally developed for use in Art History was generalised, and then successfully customised for use in the diverse areas of Education, Child Development, Architecture, Ocean Science and Mathematics (SoURCE, ii). Each customisation was carried out in consultation with the teacher, and required only a few hours of technical support.

5.2. Research-led teaching

The use of repurposable learning activities of a type used on the DART project can support research-led teaching. Their combination of instructor-generated resources within a framework that provokes discussion and interaction provides a rich environment for students to engage deeply with the subject matter.

It is necessarily a time-consuming task to populate an activity with appropriate resources and to plan out how best to use it within a specific teaching context. Repurposing should therefore not be viewed as a time- or money-saving strategy. However, as we have argued, it is exactly this participative design effort from the teacher that is required if reuse is to be successful. Teachers can make repurposable learning activities authentically fit the course they are teaching, rather than trying to shoehorn in fixed learning objects.

The research used will in some instances, constrain reuse because of copyright and other access restrictions on particular resources. In the original use of the activities described above, they referenced current research in online journals that could only be accessed by students if the appropriate licences had been obtained by the institution. The activities also make much use of the personal research materials of the teachers concerned. Such restrictions may limit reuse, but not necessarily repurposing.

5.3. Repositories

Learning object repositories and current metadata schemata do not as yet easily accommodate generic objects designed for repurposing.

Our work with the Jorum repository suggests that, while current metadata schemata support the cataloguing of a single learning object with fixed content, they do not so easily support the inclusion of generic learning activities. The subject-based classification system used does not allow a teacher to easily identify repurposable activities that might fit their requirements, because such activities are (to some extent) subject-independent. Nor does the system currently discriminate effectively between content-oriented learning objects, and more generalisable learning activities.

The current subject-based nature of learning object repositories means that these are unlikely to be an effective means of distribution for such activities. If repurposable

learning activities do become more prevalent, more thought will be needed into how allow teachers to find and use them.

5.4. Learning design modification

Finally, repurposing of the activity not only involves changing the content, but also a modification of the original pedagogical intent, or in some cases the development of new pedagogical approaches.

Our work demonstrates that in practice a learning design will undergo modification or change during the repurposing process – specific examples have been described in section 4. We believe this is a necessary part of the process as the teacher takes the activity or resource and *makes it their own*. The original use of the activity will work as a "cognitive catalyst" for the teacher as they work through and shape it into a new instantiation.

If we understand that this is part of the normal process of repurposing, it sheds light on the "not invented here" syndrome. Our work suggests that this reaction is perfectly understandable, and that part of the process of successful adoption is the repurposing both in terms of content and pedagogical design of the resource. This is of course not the same starting again from scratch; the design of the activity should support this process, so that the new user can build upon what has already been done.

Conclusion

The DART project is addressing a range of questions regarding the use of learning activities in teaching, including issues of reuse and repurposing. Customisable learning activities such as those we have described can empower a teacher to do the repurposing themselves, and the provision of authoring tools minimises the need for support from IT professionals and learning technologists. The flexibility of such activities also allows the teacher to modify the learning design of the activity to better fit their own context. We believe that such an approach is more likely to lead to successful reuse than the aggregation of fixed learning objects.

The DART approach keeps the teacher at the centre of the repurposing process, since successful reuse or repurposing requires clearly articulating a pedagogical intent and allying it with the appropriate choice of resources. This will inevitably place demands on the teacher's time, but results in the potential to develop more engaging learning experiences for students.

Based on our findings, we argue that if learning objects developers were to create repurposable learning activities rather than fixed learning objects, their creations would have both a greater potential for reuse and have a greater pedagogical impact. Teachers, rather than searching for an elusive cocktail of reusable learning objects that will serve their needs could then focus their efforts on reworking the activities to draw on the research relevant to their teaching in ways that address their specific pedagogical objectives.

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