Resource Reuse in ie-TV

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The convergence of communications and information technology within education, as well as more widely, means that concepts developed within ITS & AIED are now applicable to a wider range of wired, and more interestingly 'wireless', technologies. Interactive TV, supported by broadband broadcasting, offers interesting possibilities for education. The use of TV (and radio) in education has a long history ¾ longer than the use of computers in education. But the traditions within which TV operates are rather different from those within which computers in education, and more particularly ITS & AIED systems operate. We can characterise ITS & AIED systems as being fundamentally concerned with individualising the experience of learners and supporting a range of representations and reifications of either the domain being explored or the learning process. The traditional division of the subject into student modelling, domain modelling, modelling teaching and interface issues reflects this concern with producing systems that react intelligently to the learner or group of learners using the system. Even where the system is simply a tool or a vehicle to promote collaboration (say), there will be a concern to monitor and perhaps adjust the parameters within which that collaboration takes place, if the system is to be regarded as of interest to the ITS & AIED community.

In an earlier paper (Luckin & du Boulay, 2001) we outlined the educational rationale underpinning a user model, the Broadband User Model (BbUM), that would support individualisation of the interaction of different users, and collaboration between users, via a system able to deliver a variety of resources in a range of media, including interactive TV. At the heart of any such system there needs to be a database of resources from which the user, the educational designer or the system itself, including the user model, can select.

A *user* may wish to determine for herself the kind of interaction that she wishes to have.
An *educational designer* may wish to use the database as part of an authoring environment in order to compose default sequences of resources, or parts of resources, for a particular class of users. Finally the *system* itself may need to access the database dynamically in order to suggest possible activities to a user (either following a user request or following the dictates of its own model of teaching).

Some of these resources will be items that were developed for other purposes, such as self-contained TV programmes, books or simulation programs. Others will be resources developed with such a system in mind. In either case the use and reuse of these resources depends on careful tagging at a level of granularity that enables them to be used both in their entire *original* form as well as *in parts*. Using a part of, for example, a TV programme implies that the tagging system will not just need to know about the domain content of that (and other parts) of the programme. It will also need to encode information about the potential pedagogic *roles* that the part might play when combined with components taken from other sources. This implies a tagging system able to encode a set of pedagogic relationships between parts (see e.g. Goldstein, 1982). This poster describes an initial attempt at such a tagging system and its use in a partially implemented broadband educational TV prototype delivery system.

Reusable Resources

The reuse of electronic educational resources and their associated metadata is not a new idea.
For example, Suthers (2000) describes useful extensions to the IEEE's Learning Object Meta-data (LOM) (see e.g., http://ltsc.ieee.org/doc/wg12/LOM_WD4.htm) designed to refine the notions of audience, community involvement, discipline, educational level and objectives and pedagogy. Another metadata system in increasing use is SCORM (see for example, http://www.adlnet.org/). Increasing use of the

Web also brings indexing, tagging and metadata issues to the fore in order to facilitate the remote reuse of education resources, see for example, the Easel project (http://www.fdgroup.com/easel/) or the Guardians project (http://www.fdgroup.com/guardians/).

At another level of granularity are schemes designed to enable the interoperability of whole systems such as that presented by Koedinger, Suther and Forbus (1999). All of these schemes imply the existence of some kind of authoring environment that enables the system designer to construct sequences of educational interactions conforming to some pedagogical plan (for an review of authoring systems, see for example Murray, 1999).

Pedagogic Relationships

Our focus is slightly different from the above in that we are concerned with the reuse of resources at a lower level than complete documents, TV programmes or computer programs. In particular we are interested in the idea of finding ways to exploit the many existing resources in the form of TV programs, books, newspaper articles etc that could be employed to assist home-based learning. At the heart of such a system is a database that stores the resources along with extensive metadata to describe them. The work of adding a new resource to the database proceeds in three stages. First of all the resource needs to be notionally subdivided into parts of sufficient size that they could in principle form building blocks that could be reassembled in a different order or intermixed with parts of other resources. In dealing with a book, for example, this subdivision might be at the level of a section of a chapter. In dealing with a TV program this subdivision might be a sequence of a few minutes. Each of these parts needs to be accessible in its own right and associated with metadata about the media type, duration, ownership etc (e.g. as in the LOM or SCORM systems mentioned above). The second stage is that each part needs to be indexed for domain content in terms of some general scheme, for example the National Curriculum (see for example, Plowman *et al*., 2000). The third stage is to tag each part in terms of the pedagogic relationships it plays within the resource it originally formed part of.

For example, imagine that a TV programme is being indexed in this way and that it consists of a number of items, originally in a chronological sequence from item 1, at the beginning, to item 70, at the end. The kinds of relationships between items that we have experimented with are shown in Table 1. Labelling the items in the TV programme using the above relationships makes explicit some of the implicit pedagogic relationships that underpin the design of the original programme. This enables the possibility of recomposing the TV programme in some other sequence that reflects a different overall pedagogical structure to the original. Moreover, each item is also tagged in terms of its position in some domain scheme (e.g. item 67 deals with mathematics Key Stage 3 of the UK National Curriculum).

RELATIONSHIP	EXAMPLE: this item
Prerequisite/Corequisite	Must be preceded by Item 34 or must be accompanied by Item 36
Analogous to	Is like Item 56
Analyses	Analyses Item 57
Background for	Provides background information for Item 49
Recasts	Is an alternative view of item 67
Applies	Applies ideas/principles from item 44
Modifies	Applies extends or modifies item 44
Assesses	Provides a test of item 44
Reflects	Provides a means of reflecting on item 44
Generalises	Is a generalisation of item 44

Table 1: Examples of Relationships between resource items

Other resources will have been tagged in a similar way, both in terms of the domain and in terms of the relationships above. This opens the possibility of constructing a new internally and pedagogically consistent programme made up of parts taken from a variety of resources.

A prototype system has been implemented based on the scheme outlined above. The system employed a database searchable in a variety of ways, including the keywords matched against video/TV captions and/or automatically transcribed speech. Metadata included such fields as ID, title, ownership, media type, format, and duration. Content categorisation included topic, target user groups, and interactivity. Form categorisation included problem, concept, description, and explanation or example. Two issues that proved more problematic than we expected were, first, the tensions between items originally designed for "sit back" TV consumption *vs*. "sit forward" computer-based work; second, the requirement from item owners that their fragments retain their original corporate branding.

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