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CompendiumLD – a tool for effective, efficient and creative learning design

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Developers and teachers go through a complex decision making process when designing new learning activities – working towards an effective pedagogical mix, combining resources, tools, student and tutor support. This paper describes CompendiumLD, a prototype tool we have built to support practitioners through the process of designing learning activities. We describe how the tool fits into our vision of a dynamic, interactive set of resources and system tools to support effective, efficient and creative learning design. It describes CompendiumLD's features and explains the rationale behind their development. It shows how the tool is intended to aid designers make choices, and plan developments, facilitating creativity and efficiency in the design process. In our conclusions we consider how such a system can support the design of effective learning activities.

Keywords: Learning design, CompendiumLD, learning activities, creativity

Introduction

The Open University (OU) is currently undertaking a Learning Design project, the aim of which is twofold:

- a) to capture and represent practice through user consultation and case studies and
- b) to support the course design process through the development of a tool and associated workshops (Conole, Brasher et al., 2008; Conole, Cross et al., 2008; Conole & Weller, 2007).

The project consists of a number of activities – including requirements gathering and evaluation to better understand the design process, assimilation of a suite of learning design tools and resources and technical development. The paper concentrates on the initial phase of technical development – namely the development of a visualisation tool for learning design. Learning design as a process is still not well understood and hence specification of tools to support it is difficult. With this in mind we felt it was more appropriate to work with and adapt an existing tool, linking tool development with interactive evaluation of its use by designers and teachers. As explained by Conole and Weller, an existing mindmapping, argumentation tool, Compendium, was chosen and adapted for some initial trials. Compendium “is a software tool providing a flexible visual interface for managing the connections between information and ideas” (<http://compendium.open.ac.uk/institute/about.htm>). The initial trials consisted of 8-faculty based workshops with over 100 participants and two external workshops at other institutions. The initial evaluation was positive, users found the tool easy to use and most importantly felt that it provided a valuable mechanism for visualising their design process, making the process more explicit and providing a useful vehicle for sharing and discussing design ideas with others. Positive feedback from these initial trials has spurred more extensive development of Compendium to generate a new version: CompendiumLD. The development of CompendiumLD has occurred in conjunction with the evolution by the project team of an approach to learning design which is characterised by four overarching principles:

1. Articulation of a formal means of describing activities
2. Facilitation of the reuse of learning activities
3. Identification of appropriate scaffolds to support the design process and mechanisms for deploying these through appropriate channels (which might include staff development guidelines, LD workshops or integrated help within an adaptive LD tool)
4. Development of a shared language and set of representations for learning activities so that individuals or small teams can discuss and share ideas or interrogate repositories of good practice and case studies. (Conole, Brasher et al., 2008).

In this paper we describe the learning design functionality that has been implemented within CompendiumLD. We relate this to other work on learning design both within the OU and more broadly. We conclude with an outline of ongoing planned developments, as well as a summary of some of the issues research and development in this area present. Our starting point is that learning design is inherently messy, creative and iterative (Conole, Brasher et al., 2008; Conole, Cross et al., 2008). Beetham notes 'good' design does not always move in a linear fashion from theory to principle to practice (Beetham, 2007, p. 37). We wanted to avoid developing a restricted tool, which essentially straightjacket users in their design process. We wanted the tool to facilitate and guide design, whilst still ensuring freedom and encouraging creativity for its users. In particular, we consider the following questions. How can a learning design tool support

- efficient design (e.g. by increasing the productivity of designers and design teams) and
- creativity in design (e.g. by facilitating utilisation of new tools or pedagogical theories)?

In our conclusions we discuss how CompendiumLD can support effective design, i.e. the design of activities which effectively enable learners to attain the intended learning outcomes

In the next section we outline the requirements gathering process, then describe the current state of CompendiumLD and consider how it relates to our two questions. This consideration feeds into the planned developments which are also described, before we discuss and conclude.

User requirements

During 2007, an institution wide user consultation on learning design requirements was undertaken (Nixon, 2007). This consultation demonstrated that design was complex and it was evident that teachers' design processes are very much embedded in their practice and prior experience, and are fundamentally tacit in nature. Nixon highlighted a number of things about design which emerged from this user consultation. The first concerns the issue of the difficulty of developing a formal LD specification; namely that learning design does not appear to fit well with current approaches to course design and production. The adoption of learning design, because it requires a more formal approach to some extent, suggests that designers and teachers need a significant change to their current working practice in creating learning activities – moving away from an approach which is fundamentally based on tacit knowledge and prior experience to one that applies and adapts more formal representations of practice. This shift is not to be underestimated in terms of the difficulty of this change in mindset. There are numerous examples showing that cultural change in successful uptake and adaptation of technologies within organizations is much more problematic and difficult to achieve than overcoming any of the specific technological challenges (Arneberg et al., 2007). The second concerns differences in user preferences; our evaluation to date suggests that individuals differ in terms of what they see as important and valuable in the design process and hence what kinds of tools and support they will find most useful to guide them. Examples from Nixon's consultation include those who felt it was important as a means of ensuring consistently that the designed product provides adequate tutor support for the learning activities, others saw it as an opportunity to empower tutors by providing them with an explicit representation of the design process and a more detailed means of sharing the designer's thoughts and ideas about the activity and how it could be used. Despite these difficulties most of those consulted recognized the value of making designs more explicit so that they could be shared and potentially repurposed by others. These user consultations, experience gained from a series of case studies (Wilson, 2007) and our review of existing representations of design, indicated that any learning design tool developed needed to take account of the fact that the design process is messy, creative and multi-faceted, hence it needed to be flexible in how it could be used.

CompendiumLD

Overview of CompendiumLD

CompendiumLD is a development of Compendium, which itself is a "nearly open source" Java application; see http://compendium.open.ac.uk/developers/os_home.php for details about its licensing. A prototype version will be freely available for download at the beginning of April 2008.

Compendium is a form of mind mapping or argumentation software that provides a default set of icons for creating maps to describe argumentation, and for communicating issues within discussions amongst interested parties (see e.g. Shum & Okada, 2008). A user can drag and drop the icons onto Compendium's user interface so creating nodes which may be linked and labelled. The three classes of node objects within Compendium that are of interest with respect to learning design are

- NodeSummary - this holds the information about the node, including its label, image, and descriptive textual information added by a user
- Link node - this holds information about a link from a source node to a destination node.
- View node - this is a subclass of NodeSummary i.e. it holds all the information that a NodeSummary does, but has additional attributes (e.g. positional information) which enable the Compendium application to create lists views or map views (Bachler, 2004).

The user interacts with Compendium via its GUI whilst the Compendium application itself maintains a data model of the nodes which are displayed, created, and edited by the user. The underlying flexibility of the "node-link-node" data model means that functionality for a particular semantic interpretation of the meaning of a node and the meaning of a link can be added without having to restrict the flexibility of the application as a whole.

Our initial evaluation of existing learning design tools, concluded that none met the requirements for an initial prototype, mainly because they already had an inherent 'design model' as part of their architecture and hence would not enable us to have the flexibility to evaluate and interact adapt based on user interaction with the tool. In contrast, despite being developed for more general purposes, Compendium is a sophisticated tool with significant functionality, which importantly could be relatively easily adapted and modified for our purposes. The inherent philosophy underpinning Compendium, in terms of providing visual representation to support the development of thinking and shared argumentation also fitted our criteria for selection, as it aligned well with our requirement to develop a tool which developed user thinking specifically for the design process.

CompendiumLD has been created by modifying Compendium's source code. Most of the modifications have been additional classes and sub-classes which realise our desired semantic interpretation of nodes to represent learning activities, roles, tasks etc. and links to link learning tasks to roles etc. In this context, our understanding of 'learning activity' concurs with Beetham's definition: "a specific interaction of learner(s) with other(s) using specific tools and resources, orientated towards specific outcomes" (Beetham, 2007, p. 28). The next section describes some of the functionality we have implemented to support design conforming to this interpretation.

Learning design functionality

Introduction to interaction with CompendiumLD

The Compendium GUI provides several different mechanisms by which a user can interact with nodes. These include drag and drop (e.g. to instantiate a node), double-clicking (to display and edit details of a node including its text), right-clicking (to display a menu offering actions and operations to apply to the node), left-click (to select a node, or allow other menu driven operations to be executed on the node). In CompendiumLD, behaviour specific to learning design has been implemented for these modes of interaction as explained in the next few paragraphs.

Stencils

Compendium provides a utility by which users can create and share new sets of icons, for use as nodes. These sets, known as 'stencils', contain 'items' where an item defines certain properties of a potential node such as its image icon and label. In the standard version of Compendium, each item inherits the behaviour of one of the standard node types. Figure 1 is a screenshot of CompendiumLD, showing the LD-OU stencil towards the left hand side, and a map describing each item in the main window.

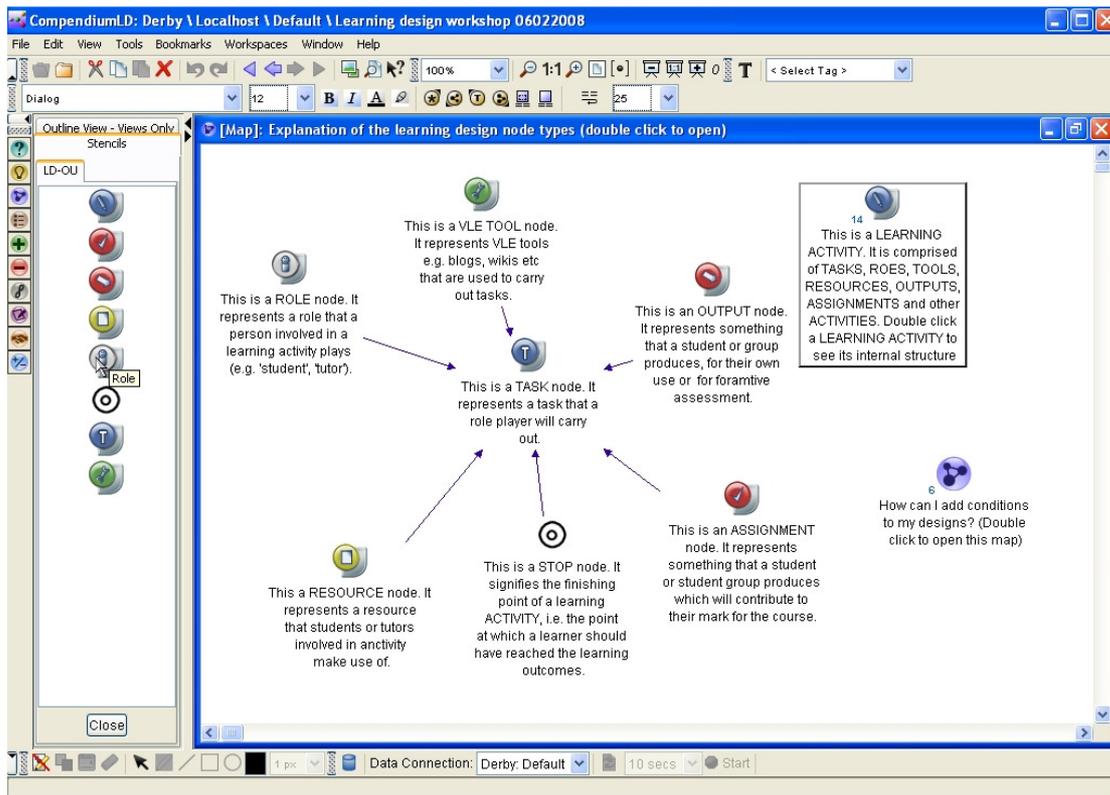


Figure 1: CompendiumLD, showing LD-OU learning design stencil

This LD-OU stencil contains items which can be used to represent activities themselves, and constituent components of activities i.e. assignments, outputs, resources, roles, tasks and tools. We deliberately choose to represent those components of a learning activity which were core to the design decision making process. The code modifications we have made give the nodes created from the LD-OU stencil specific behaviour to support learning design. Other stencils we have developed include

- the LD-Conditional stencil, for including conditions within designs (e.g. if X then Y),
- stencils containing activity templates i.e. abstract activities which can be edited to suit particular applications, and
- stencils describing approaches to design, and providing links to other resources to support design.

Drag and drop prompts

In addition to providing a visual representation of the design process, we also wanted the tool to provide some form of in-built scaffolding and support to guide decisions at various points in the process. This we have achieved in a number of ways – by providing suggestions for each of the different types of nodes, additional resources and examples, and access to a restricted searchable set of additional help features. As an example of the first kind, when a user drags and drops a “role” node onto the main design area, they are presented with a menu to select the type of role as shown in figure 2(a). Therefore this simple prompt reminds them of typical kinds of roles which they might want to include in their design sequence. The users are not restricted to these roles however and can choose to type in an alternative role of their specification. This sensitive balance between guided scaffolding and user flexibility/creativity is an important design principle for our development of CompendiumLD. A similar form of scaffolding is available for the “tool” mode. When a user drags and drops a tool node onto the main design area, they will be presented with a menu to select the type of tool as shown in figure 2(b). Note that the options for tools include “Other”; this allows the user to specify a tool of their own choosing. The other tool types available for selection are those currently available with the Open University’s VLE. The “Other” type allows the designer to specify a tool for face-to-face interactions, or a tool not currently supported by the VLE. The tool type selected is stored in CompendiumLD’s data model, and tools to query the contents of this data model could be used to examine tool usage.

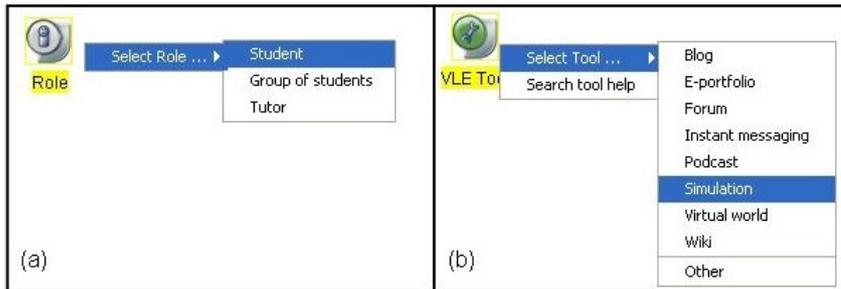


Figure 2: Prompts presented after role and tool nodes are dropped

Context sensitive help

In terms of provided additional help, users of the system have the option of letting CompendiumLD offer context-sensitive help. For example, as the designer types into a task description label, the words typed are scanned and help related to selected verbs (e.g. collaborate, consider, discuss, reflect etc.) pops up. An example of such a help window is shown in Figure 3. In this example, the designer has typed 'Discuss' into the task label: this prompts the application to pop up a window showing tools to support discussing and existing activities that include tasks which include the word 'discuss'. The set of tools shown in this help window are selected using a verb-to-tool look-up table based on verbs within a task taxonomy similar to that described by Falconer et al. (Falconer, Conole, Jeffery, & Douglas, 2006); the set of activities is generated by searching the database maintained by CompendiumLD for activities including tasks with 'discuss' in their label. Further help is provided by the 'About..' buttons. These buttons initiate a customised Google search of selected web sites

(<http://www.google.com/coop/cse?cx=000971387191123125524%3A1woruyth0qs>). The web sites were chosen because of the quantity and quality of the information they provide about use of tools in learning and include sites such as <http://www.learningdesigns.uow.edu.au/> and <http://www.educause.edu/>. We adopted this pragmatic approach for a number of reasons. To create our own hand crafted text would not only be time consuming but would suffer from quickly becoming dated. However the alternative of a free Google search arguably produced a daunting and untargeted set of resources. The middle approach we have adopted enables us to focus in on a small set of quality assured sites, which we have checked for relevance and which are likely to be sustained and updated in the near future. Using a customised search allows means that potentially other institutions installing versions of CompendiumLD could choose to select and include their own tailor made set of resources, which might include institution-specific examples. In our own case we have a set of tailored resources on tools and their uses within the OU context – 'the learn about guides', as well as a set of institutional cases studies on specific uses of VLE tools.

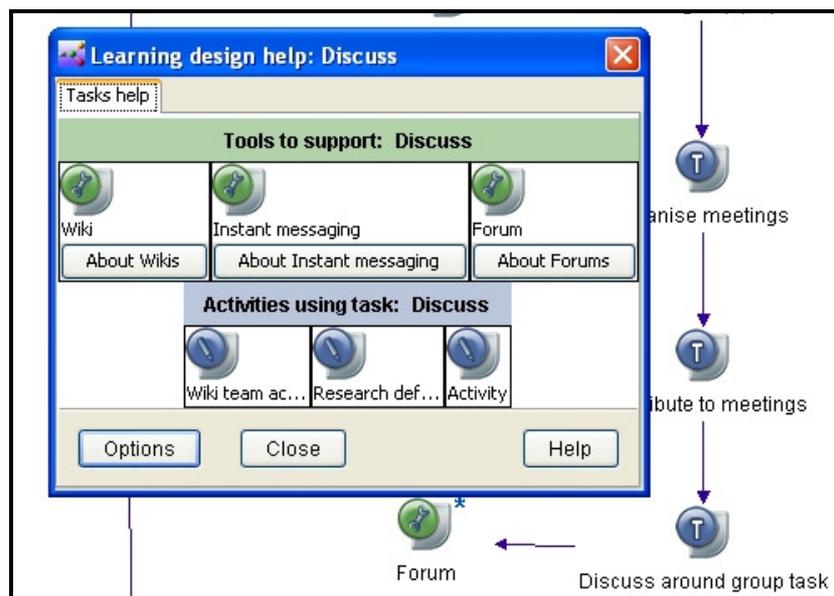


Figure 3: Help relevant to a particular activity

Help related to tools that the designer drags and drops onto the window may also be shown. Figure 4 shows an example of help presented when the designer selects 'Wiki' for the tool type.

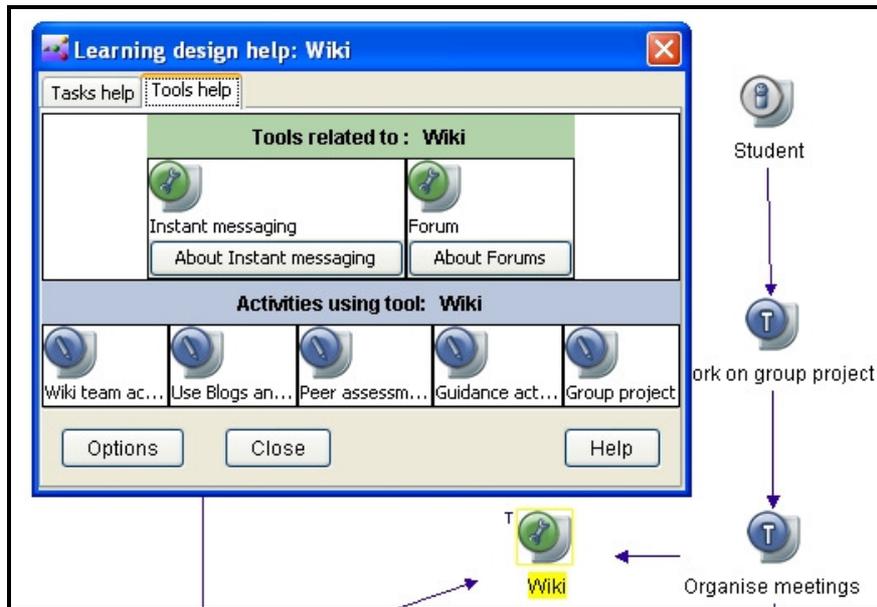


Figure 4: Help relevant to a particular tool

Outline view

A minor change to the existing functionality to display outlines of views enables designers to see the structure of multi-level learning activities at a glance. This means that CompendiumLD potentially could support design across a number of different levels of detail. For example Jones refers to meso, micro and macro levels – where meso refers to the HE programme level, micro the level of specific learning activities, and macro the level of learning infrastructure or environments (Jones, 2007).

Figure 5 shows CompendiumLD's outline view on the left hand side. This example shows nested levels of activities and maps; clicking on an activity in the Outline view opens that activity in the main design window.

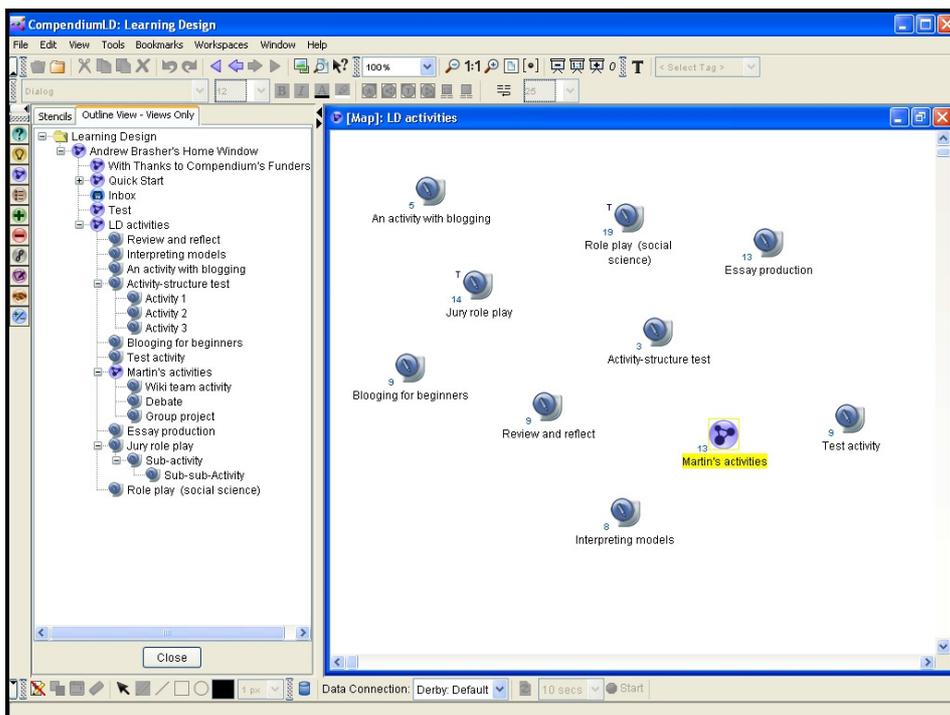


Figure 5: CompendiumLD's outline view

Discussion: support for efficiency and creativity

In this section we discuss the perceived benefits of CompendiumLD with respect to efficiency and creativity, leading up to our conclusions which describe areas for further research. It is clear that the notions of efficiency and effectiveness are intertwined. An efficient system can be characterised as one that achieves a desired result with minimum wasted effort or expense, i.e. a system that facilitates its users to be productive. With respect to learning design, a desired result will usually be expressed in terms of educational effectiveness. We recognise that it is very difficult to be precise about causation of educational effectiveness, particularly when media variations are involved (see e.g. Joy & Garcia, 2000). However, we can still identify functionality within CompendiumLD that we believe contributes to efficiency for given results (e.g. the design of wiki based activities for social science courses) as a first step towards developing a strategy for evaluating it.

Functionality that could increase efficiency

A flexible visual design tool like CompendiumLD offers users the opportunity to record and communicate their design ideas in detail. Our view is that increased efficiency can be achieved if the communication opportunities it offers are exploited by those involved in the design and production processes (e.g. academics and technologists). It is clear that some of these factors may also make contributions to the learning processes involving lecturers and students. Factors which could affect efficiency include

- Recording and communication of design decisions
 - CompendiumLD provides facilities for the designer to add notes and tags to specific nodes in their design
- Use of templates
 - activity templates, representing different means of thinking about the design process are provided and can be used as starting points for designs – starting with an existing template arguably speeds the process of design and can help provide guidance on thinking about particular aspects of the design process
- Visualisation of design at different levels
 - as illustrated in figure 5. Design is multi-faceted and occurs at different levels, and at different times in the design process. Evaluation feedback from our workshops, analysis of a series of institutional case studies and on ongoing interviews with individuals about how they go about design shows that a variety of strategies are adopted for design including focusing on learning outcomes, tools, resources, activities, support requirements, assessment, etc.
- Context sensitive help
 - Different users are likely to need different levels of support and more detailed, context sensitive help is particularly helpful for novice designers
- Export to image and xml
 - activities can be exported as images or in HTML format facilitating communication with other people, or in XML for sharing editable designs amongst Compendium users. This choice of export formats is useful as it means designs can be shared between different users for different purposes e.g. the XML export facilitates groups of users working together on a design.
- Drag and drop of resources.
 - One of the selection criteria for choosing Compendium was the fact that it can deal with multiple file formats easily; resources such as Word documents, PDF files or web pages can be dragged and dropped onto a learning activity map
- No need to save
 - CompendiumLD saves the current state of a design automatically

Some of the additional functionality we are exploring is more in-depth productivity support, such as time per task, and time per activity, visualisation of learning objectives and other metadata elements.

Creativity support

Schneiderman has identified several design principles for creativity support tools (Schneiderman, 2007). Briefly, the principles identified by Schneiderman can be expressed in terms of functionality that a tool should offer, whatever the domain of application:

- **Enables collaboration**
Evidence from the research literature supports the notion that processes that lead to discovery and innovation are often highly collaborative (Fischer & Giaccardi, 2007), indeed this is one of the principles underpinning the OU adopting a team based approach to course production. “Communications systems that let users expose their uncertainties in a safe environment could help build trust, and designs that record who said what can document contributions to emerging ideas. Trust, accurate records, and safe exchanges are also needed in the middle stages when information gathering, idea refinement, and knowledgeable partners are important. In later stages, when validation and dissemination become dominant, finding appropriate test situations, preview audiences, and media partners is helpful” (Schneiderman, 2007, p. 26)
- **Support for exploratory search**
Another facet which is important is providing the ability to build on prior work. An awareness of previous and related work is necessary for true innovation. Tools which enable targeted searches, e.g. to locate and review existing design work are necessary.
- **Provide rich history-keeping**
The benefits of rich history-keeping include providing users with a record of which alternatives they have tried, allowing them to make comparisons between alternatives, and the capability to return to earlier alternatives to make modifications.
- **Design with low thresholds, high ceilings and wide walls**
Tools should be easy for novices to begin using, yet provide ambitious functionality that experts need

The standard version of Compendium has features which show support for some aspects of these design principles, and in the prototype CompendiumLD we have extended this functionality to suit its use as a learning design tool. This is summarised in the next few paragraphs.

Enables collaboration

A learning activity can be exported from CompendiumLD as an XML document, and imported by another designer into their installation of the tool; this enables many designers to work iteratively on the same design. This mechanism of design sharing is rudimentary, but it works. Designers can use features such as Compendium’s note, question, and answer nodes to include information and queries about a design within the design map. In the discussion and further work section we suggest some improvements which can be made to the way that designs are shared. Compendium itself has a Jabber interface through which instant messages containing node data can be sent using the Jabber protocol (again, see the discussion and further work section). Lastly, an activity can be exported in HTML format, either as a map or a structured list of the nodes in the map. Though further work is necessary to tune these HTML exports to suit our learning design application, as it stands activity information can be exchanged with people who do not have a copy of CompendiumLD.

Support for exploratory search

Compendium itself provides search functionality, but out of the box searches are limited to either its own database, or a standard web search. As described under ‘Context sensitive help’ we have prototyped a targeted web search primarily aimed at providing help for designers. CompendiumLD’s search facilities mean that the user can search for any learning CompendiumLD node type which meets users’ specified criteria, but this search operates on the users own local database. Compendium’s source code provides an API through which its database can be opened for synchronous or asynchronous connections without going through its user interface. This API could be used in a number of ways to contribute to exploratory search in support of learning design creativity, e.g. by exposing a designer’s creations to other search tools through the web (see the discussion and further work section for more information).

Provide rich history-keeping

CompendiumLD uses Compendium’s mechanism for storing node information, so the authors and dates of creation and last modification of all nodes are stored within its database, and may be viewed via its user interface. As suggested under ‘Enable collaboration’, designers can use features such as Compendium’s note, question and answer nodes to include history information about a design within a design map, thus

enabling manual tracking of version information. Code is in place to enable tracking (and back tracking) of edits within Compendium, but further analysis of requirements is needed to establish if the overhead of switching this on would outweigh the potential benefits for learning designers.

Design with low thresholds, high ceilings and wide walls

As described under 'Context sensitive help' we have prototyped a targeted web search primarily aimed at providing help for inexperienced designers, and help to aid designers choose suitable tools (figure 4) and explore relevant activities (figure 3). CompendiumLD extends Compendium's functionality rather than restricts it: it may be that to achieve a low threshold some functionality should be initially hidden from novice users.

Conclusions

One driver behind the learning design concept was the desire to reuse patterns. The motivation was towards efficiency as much as creativity. However, every time a pattern is applied, a choice has to be taken about the resources, group sizes etc in the particular use of that pattern. In this notion of learning design, creativity can be seen in the design of new patterns, but also in knowing when to use a certain pattern and when not to (McAndrew & Goodyear, 2007). This is borne out by the experience of the LAMS community, where straight reuse is rare, but rather taking an initial design as a starting point or inspiration is more common (Dalziel, 2006).

Turning to the notion of the effectiveness of a particular learning design, we suggest that the system within which CompendiumLD operates must be one which supports the user making the best possible choice of design. It should recognise that this might not be a unique solution, that there are many learning paths that learners can take to achieve a particular learning outcome, but it should reduce the probability of a bad design choice being made. A learning design can only be effective once it is implemented, i.e. when it is enacted in a classroom or electronic environment with learners. With this in mind, we agree with Jones' view about the situatedness of design (Jones, 2007, p. 177), but argue that a learning design tool such as LAMS or CompendiumLD can contribute to improving the overall effectiveness of the act of learning design, and the act of implementation i.e. use of a design in a particular learning and teaching context. However, to do so, CompendiumLD must exist within a greater system; a methodological and technical system.

We suggest that two mechanisms can play here. Firstly, there is the notion of trust, and of recognised expert learning designers. We all know someone who we would ask for advice about a specific topic (e.g. design of a collaborative activity for foundation level psychology degree course about research methods). If a system existed which facilitated this social element, or provided a means of gauging the reputational status of contributors, it would allow trust to become a factor. Secondly, some institutions, the OU included, carry out regular surveys which ask for students' reactions to a course. This type of learner feedback would also be a metric to measure the quality of the design

The kind of technical system we envision CompendiumLD should sit within is one which supports effective, efficient and creative learning design. In order a community of people to collaborate on learning designs effectively, the designs would need to be saved to a shared database. We envision a system including a database of designs together with a generic API for saving and retrieving designs in different formats such as LAMS sequences, IMS learning designs etc. Such an API would require functions to save a version of the design, to share it for reading or for editing with specific people, to view the revision history, to view previous versions and to revert to previous versions.

In this paper we have described the perceived benefits of the approach we are taking, and outlined implementation work that is required before we can begin to fully evaluate the approach. Future work will include further development of CompendiumLD, building a prototype of the greater system we discuss above, and evaluating both CompendiumLD and this methodological and technical system.

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