Documenting learning environments and experiences

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At their best, ICTs can support knowledge construction, learning-by-doing, by conversing and by reflecting (Jonassen, 1999) but managing all this in a student-centred environment is a complex task that might be made more manageable by teachers sharing and re-using effective learning designs. Furthermore, if these designs were available in machine-readable format, educators would be able to select a learning design to suit their context "off the shelf" and plug-and-play it.
A number of attempts are currently being made to comprehensively document learning designs that would allow educators to share successful, stimulating and engaging learning environments and experiences. IMS-LD, LAMS and the AUTC Learning Design Project are three developments where a comprehensive system is being produced that utilises a consistent data standard and vocabulary to describe the teaching and learning environment and the different theoretical approaches employed (Oliver & Littlejohn, 2006) and two of the three are machine-readable (INS-LD and LAMS).
This paper provides a review of each of these methods of documenting learning designs and details the results of a study that demonstrated that a system that educators can use to comprehensively describe successful, stimulating and engaging learning designs so that they can be shared and re-used is still beyond the reach of the average pre-service teacher. However, all have features that illustrate that the dream of an easy-to-use, machine-readable and comprehensive learning design documentation system may not be too far away.

Keywords: learning design, IMS-LD, LAMS, generic templates, AUTC, online learning, pre-service teacher training.

Introduction

Throughout this paper, the term "learning design" refers to "a general method of comprehensively describing the teaching and learning process". Although a relatively new term, learning design has been implemented by classroom teachers for decades. It involves the formulation of learning goals and objectives and the design of teaching and learning resources and strategies that are best suited to achieve these objectives (Kinchin & Alias, 2005). Additionally, it involves sequencing appropriate learning activities in a logical order and designing assessment tasks and lesson evaluation criteria (McCutcheon, 1980).

Preparing a learning design can help our Teacher Education students plan for instruction; enable them to consider different options and to be more flexible; assist with evaluating instruction; and help them to build up confidence in their teaching (Marsh, 2004). This should be justification enough for the practice but documenting a learning design is also considered a valuable goal by the School of Education lecturers at Macquarie because by adopting a consistent and compatible approach to the description of learning and resource design, our students will be more effective in:

- Documenting the teaching strategies used in, or with, those resources;
- Establishing and adhering to prescribed procedures for assuring the consistency of that documentation;
- Re-using elements of existing teaching resources;
- Guaranteeing portability between ICT systems;
- Readily adapting designs; and
- Collectively authoring and sharing designs (Beetham, 2004)

Traditionally, a written lesson plan is how our Teacher Education students have been asked to document their learning designs. Although a variety of written lesson plan formats and approaches are currently in use within the School, the dominant model has varied little from its introduction by Tyler's *"Basic principles of curriculum and instruction"* which was published in 1949. This model has tended to

encourage conventional, structured and linear approaches to learning (John, 2006) whereas educational theory has advanced the practices of more student-centred, constructivist and authentic approaches to teaching and learning (Oliver & Littlejohn, 2006) in the last decade.

With the advent of e-learning, a need has arisen for a semantic, formal and machine interpretable way of representing learning design (Koper & Olivier, 2004). If it is realisable then there are important implications for learning, since it allows exemplar models to be developed (McAndrew, et. al., 2006) and this would enable educators to select a learning design to suit their context "off the shelf" and plug-and-play it.

The question facing those working in this field is to what extent a generic description approach is achievable and practical (McAndrew, et. al., 2006). Therefore any attempt to document a learning design, whether computer-based or otherwise, must be ultimately accessible to the teacher and easily adaptable so that it can readily represent the processes required in a rapidly changing environment. It must also be flexible enough to allow new approaches to be described, and even anticipated, as they emerge (Beetham, 2004). It was these issues our study sought to test.

The project

An initial study was undertaken over two semesters in 2006 with a total of 186 undergraduate pre-service teachers (77 male and 109 female) using only LAMS (Learning Activity Management System software) to document their learning design. This was then followed up in 2007 with 69 students (28 male and 41 female) and 12 postgraduate students (7 male, 5 female) whereby each student was required to construct a learning activity using their choice of three methods of learning design documentation: IMS-LD, LAMS or the AUTC Learning Design exemplars (each of these systems are described at length below). None of the students who took part in either study had had any previous experience with learning design notation but some were familiar with computer programming languages. To provide the students with some experience with the learning design systems before they were asked to document their own activities, course tutors provided course materials utilizing learning design examples in all three formats (IMS-LD, LAMS and AUTC Learning Design) on at least two separate occasions. Additionally tutors gave the students an opportunity to de-construct pre-existing documented learning designs.

Class time was provided so students could begin their learning design documentation under the supervision of their tutor but students were encouraged to collaboratively work through issues with their peers. Before final submission, students were given a further opportunity in class to workshop their documented activities with their peers during which time they were encouraged to work collaboratively through any difficulties.

A survey to determine the perceived benefits and limitations of each method of documentation was constructed. Twelve survey questions focussed on the effects of the learning design documentation method in the recording of their learning activity in the following areas:

- recording all detail of their activity;
- previewing their lesson from the learners' perspective;
- providing a visual overview of the activity to identify the learning styles addressed with the activities employed; and
- creating a standardised template that might be easily modified for future re-use.

Participants were asked to rank the effectiveness of each aspect on a scale of 1-5. The survey was completed by a random selection of 60 students from the 2006 group and the results of the survey were subsequently followed up by two focus groups of 14 students. In these sessions the participants were asked to expand on the survey questions to ensure they had not misconstrued any of the questions and the sessions were also used to verify the researchers had interpreted the survey responses correctly.

In 2007, the same survey was completed by a random sample of 27 undergraduate and 7 postgraduate students. Four staff members new to learning design documentation also participated in the survey on each occasion.

The survey results showed that a system that educators can use to comprehensively describe successful, stimulating and engaging learning designs so that they can be shared and re-used is still beyond the reach of the average pre-service teacher. However, even thought the approach of each of the three examples

described is quite different, all have features that illustrate that the dream of an easy-to-use, machine-readable and comprehensive learning design documentation system may not be far away.

In the survey, a majority of the students identified the cross-platform operability feature of IMS-LD as a highly desirable characteristic of any learning design documentation system but without XML expertise, any attempt to describe a learning design as IMS-LD was arduous and time-consuming, and, for our pre-service teachers, mostly unsuccessful. All those surveyed agreed the product of their LAMS design was a workable machine-readable activity and all but one student was able to describe a learning activity satisfactorily as a working LAMS sequence. Most students found the AUTC Generic Design Templates simple to understand and the consistent design symbols and language would facilitate re-use. However, many of those surveyed were concerned the product of their efforts was simply "paperwork, that is, unlike the other two systems, this one did not produce machine-readable activities.

A description of each of the systems trialled and the survey results evaluating each of the three methods of documentation used in the study are described individually below.

Example 1: IMS-learning design specification (IMS-LD)

Description

The goal of the IMS-LD Learning Design workgroup (http://www.imsglobal.org/learningdesign/index.html) is "to enable many kinds of educational designs to be created, using a consistent notation, which can be implemented uniformly in multiple course or learning programs" (IMS, 2006). Initially, the IMS-LD project set out to produce a unified specification covering all the areas of metadata, content, administrative systems and learner information. This specification proved to be too large so IMS-LD divided the specification into component parts, with separate working groups developing each (Currier, 2003).

The IMS-LD is a language for modelling units of learning. A learning design, modelled using the language described in the IMS-LD Specification captures who does what, when and using which materials and services in order to achieve particular learning objectives. The IMS-LD Specification is an abstract, conceptual model that is able to express various pedagogical approaches. Content can be adapted to personal needs and assessments can be integrated (Koper & Olivier, 2004).

The specification describes the constructs of the language and gives a binding in XML. The XML document instance is "loaded into" an IMS-LD-aware application and "played". Playing an IMS-LD instance means that once people are assigned into the various roles in the learning process, the various activities prescribed in the document instance can be performed (IMS, 2006). The relationship between the IMS-LD language and an IMS-LD player is analogous to the relationship between HTML and a browser. An IMS-LD player might be a separate application or could be functionality incorporated into a learning management system.

"IMS Learning Design relies on a number of elements. These include: roles that people perform (who does what); activities (what they do); and environments, which include where they do them (services) and what they do them with (learning objects). The overall scenario or design is described within the method element, which contains play, act, and role-parts elements, and is analogous to a theatrical play. A learning design may be based around the achievement of specified learning objectives by learners; it may also define prerequisites" (p. 1, Currier, 2003). A diagram (Figure 1) of the conceptual structure follows:

There are three implementation levels within IMS-LD Specification: Level A contains the core of IMS Learning Design: people, activities and resources, and their coordination through the method, play, act and role-parts elements. Level B adds greater control and complexity through the use of properties and conditions. Level C offers the opportunity for more sophisticated learning designs through notifications (Currier, 2003).

Advantages of IMS-LD identified in surveys

- All learning designs described this way are machine-readable;
- A universal standard means cross-platform operability.

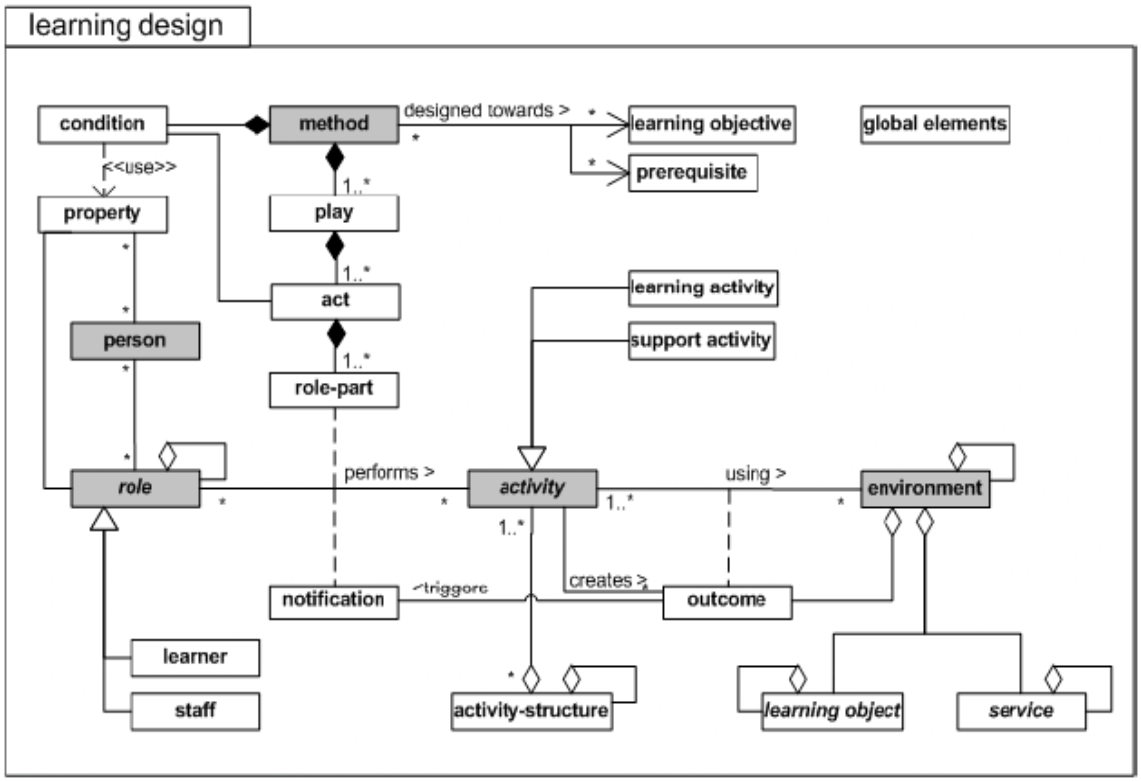

Figure 1: Conceptual structure of IMS-LD specification (Koper & Olivier, 2004)

Limitations identified

The IMS-LD does not incorporate a user-interface (player), however, a number of players are in various stages of development. The most developed are: Coppercore (http://coppercore.sourceforege.net), which is currently intended for use by software developers who will plug the runtime engine into their software, and, in the future, e-learning systems integrators; and Reload (www.reload.ac.ak), the current editor of which is designed for content developers who have some level of technical knowledge (Britain, 2004).

Discussion

A majority of the students (89%) identified the cross-platform operability feature of IMS-LD as a highly desirable characteristic of any learning design documentation system. However, as can be seen by the included portion of an example of an IMS-LD learning instance (see Figure 2), the coding is quite complex and very detailed. Both students and staff reported difficulty (100%) with any attempt made to describe learning activities in terms of the IMS-LD specification. Without XML expertise, any attempt to describe a learning design as IMS-LD was arduous and time-consuming, and mostly unsuccessful. By using a use-case example as a basis, one student produced an approximation of what a learning activity might look like in IMS-LD which was 15 pages in length but this product was not considered sharable or re-usable by any of the staff or students surveyed (none of whom had any XML experience).

While theoretically all the learning processes in the activities in the students' learning designs could be described in XML (IMS, 2006), without an XML programmer creating the code, this method is not practicable. Even if the services of such a programmer was obtained, any on-going revisions or alterations to the code would have to be done professionally.

On a more basic level, there is no player capable of running this code in a real time activity without difficulty. Figure 3 illustrates a student's attempt at achieving a more visual representation of the IMS-LD specifications using Reload (http://www.reload.ac.uk/) but this was also difficult and time-consuming to use, and the product challenging for the average end user to interpret. It was concluded that without significant professional technical help, learning designs will not be able to be designed to the IMS-LD specification by our students or staff.

```
Education" uri="" level="A">
         <imsld:components>
            <!-- -->
            <!-- ROLES -->
            <imsld:roles>
<!-- STUDENT ROLES -->
               <imsld:Student identifier="Student">
                  <imsld:title>Student</imsld:title>
               </imsld:Student>
               <imsld:Student identifier="Group A">
                  <imsld:title>Discussion Group A</imsld:title>
               </imsld:Student>
               <imsld:Student identifier="Group B">
                  <imsld:title>Discussion Group B</imsld:title>
               </imsld:Student>
               <imsld:Student identifier="Group C">
                  <imsld:title>Discussion Group C</imsld:title>
               </imsld:Student>
               <imsld:Student identifier="Group D">
                  <imsld:title>Discussion Group D</imsld:title>
               </imsld:Student>
               <imsld:Student identifier="Group E">
                  <imsld:title>Discussion Group E</imsld:title>
               </imsld:Student>
               <imsld:Student identifier="Group F">
                  <imsld:title>Discussion Group F</imsld:title>
               </imsld:Student>
               <!-- STAFF ROLES -->
               <imsld:staff identifier="Tutor">
                  <imsld:title>Tutors</imsld:title>
               </imsld:staff>
            </imsld:roles>
            <!-- -->
            <!-- ACTIVITIES -->
                     <!--  ACTIVITIES  INCLUDE  AN  ACTIVITY  DESCRIPTION  AND  A  LINK  TO  AN
ENVIRONMENT. -->
            <!—ENVIRONMENTS CONTAIN REFERENCES TO LEARNING OBJECTS AND SERVICES. -->
            <imsld:activities>
               <!-- INTRODUCTORY OVERVIEW -->
               <imsld:learning-activity identifier="EDUC_261">
                  <imsld:title>EDUC_261 Aims and Objectives</imsld:title>
                  <imsld:environment-ref ref="EDUC_261_Aims"/>
                  <imsld:activity-description>
                                                                        <imsld:item   identifier
EDUC_261_AD_res"/>
                  </imsld:activity-description>
               </imsld:learning-activity>
               <!-- INTRODUCTION TO PREPARATION -->
               <imsld:learning-activity identifier="Preparation_Intro">
                  <imsld:title>Introduction to Preparatory Activities</imsld:title>
                  <imsld:environment-ref ref="EDUC_261_Prep_Intro"/>
                  <imsld:activity-description>

identifierref="RES-Preparation_Intro_AD_res"/>
```

Figure 2: A small portion of an XML document Instance used in the course

Example 2: Learning activity management system (LAMS)

Description

LAMS (http://www.lamsfoundation.org/) is an online web-based system for creating, managing and delivering sequences of collaborative learning activities. The visual authoring environment is designed to be easy to use by non-technical teaching staff and the run-time features allow real-time monitoring of the performance of learners (Britain, 2004). The basis of the system is a visual editor that allows teachers to design a learning activity (see Figure 4). By dragging and dropping activities like Chat, voting, etc., online lessons can be designed much like a conventional lesson (Kraan, 2003).

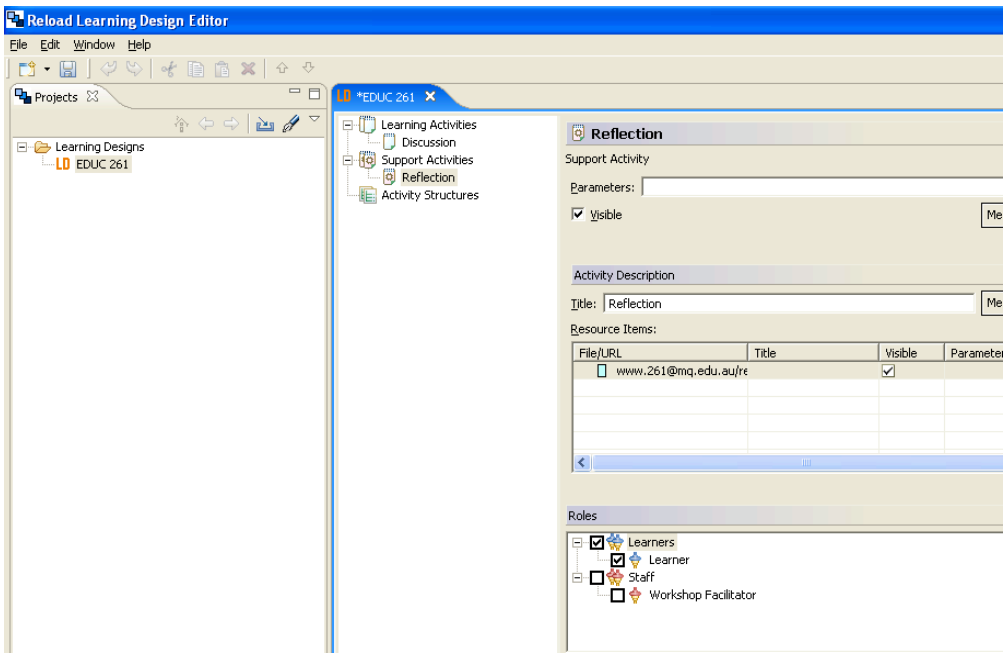

Figure 3: Reload design of a course

Advantages of LAMS identified in surveys

- It is an intuitive visual environment that allows teachers to design their own learning designs. It is user-friendly to the point where professional technical help is not required to develop a learning sequence;
- The product of documenting the learning design is a fully functioning machine-readable activity or activities;
- The "preview" mode allows the teacher to immediately "see" how the design will appear to their students;
- Sequences are simple to edit, allowing lessons to be continually improved and reused;
- The environment readily links the learning design to the underlying pedagogical theory (Smart, 2005).

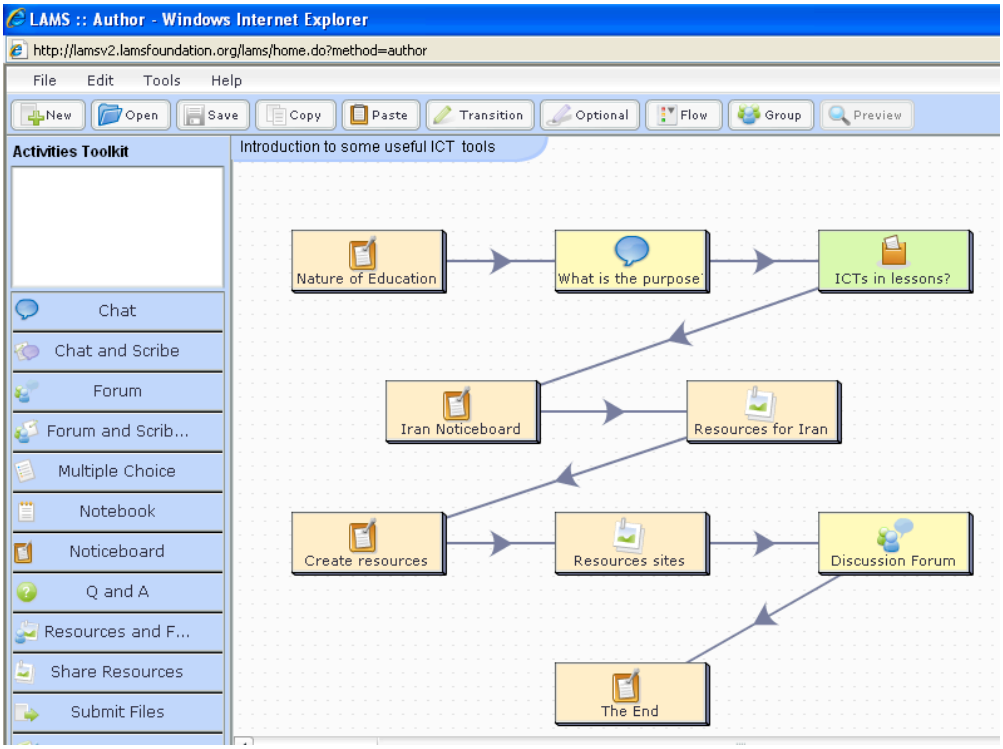

Figure 4: LAMS graphic interface Dalziel (2005)

Limitations identified

- LAMS is lacking in some features, eg. ways are needed to pass information from one tool to another; nor is branching with a sequence currently possible;
- The designs will only run in the LAMS environment and there is no "lite" player for viewing completed sequences (McAndrew, et. al., 2006).

Discussion

All but one student was able to describe their learning activity as a working LAMS sequence without any specialised programming expertise. However, it was agreed by the majority (72%) that without any supporting documentation some detail of lesson delivery is lost. Yet all (100%) those surveyed agreed the product of this design was a workable machine-readable activity. Additionally, LAMS provided a visual overview of the activity that was considered useful by many of those surveyed (83%). 97% found the ability to preview their learning activity from a student's perspective valuable and 98% regarded LAMS as an effective system to promote re-use of learning designs.

Example 3: The Australian universities teaching committee (AUTC) learning designs project

Description

The AUTC Learning Designs project (www.learningdesigns.uow.edu.au/index.html) focused on the development of generic learning designs, based on exemplary teaching and learning practice in higher education supported ICTs. A graphical representation was developed to document the learning designs in terms of the tasks, content resources and support mechanisms and how they were sequenced for students (Oliver & Herrington, 2001) (See Figure 5).

Information is also provided as to how the design was derived from theory and/or practice, the research evidence to support the approach, guidance about how it should be implemented and ideas as to how the design might be adapted to other learning contexts (Agostinho et al., 2002).

The representation's underlying structure of tasks, resources and supports was seen as a useful mechanism to focus on the tasks students are required to complete and delineate the content resources to be provided to help students complete the tasks and how they are to be supported in the learning environment. The other significant feature deemed effective is the chronological sequencing of tasks, as this explicitly illustrates the order of tasks in the learning design (Agostinho, 2006).

Documenting a learning design visually aids the documentation and communication process (Cameron, 2006, Peterson & Snyder, 1998). Participants in the Agostinho et al. study (2002) used the graphical representation to:

- Communicate and discuss pedagogical ideas;
- Summarise and communicate a learning design; and
- Reflect on an implementation of the course/subject.

Advantages of AUTC generic learning design models identified in surveys

- They facilitated rich learning experiences;
- They triggered thinking about new approaches, activities and strategies (Bennett, Lockyer, & Agostinho, 2004);
- The designs use consistently placed tools and predicable structures which students found easy to use.

Limitations identified

- Modifying generic templates took a significant amount of time;
- Without providing a rich specific example, a generic design may by necessity be bland;
- This system does not produce machine-readable activities;
- Generic learning designs can be difficult to interpret as a stand alone resource (Bennett, Lockyer, & Agostinho, 2004);
- If a particular generic design is over-used with the same students, they will become bored with the sameness of their lesson designs (Sneider, 2005).

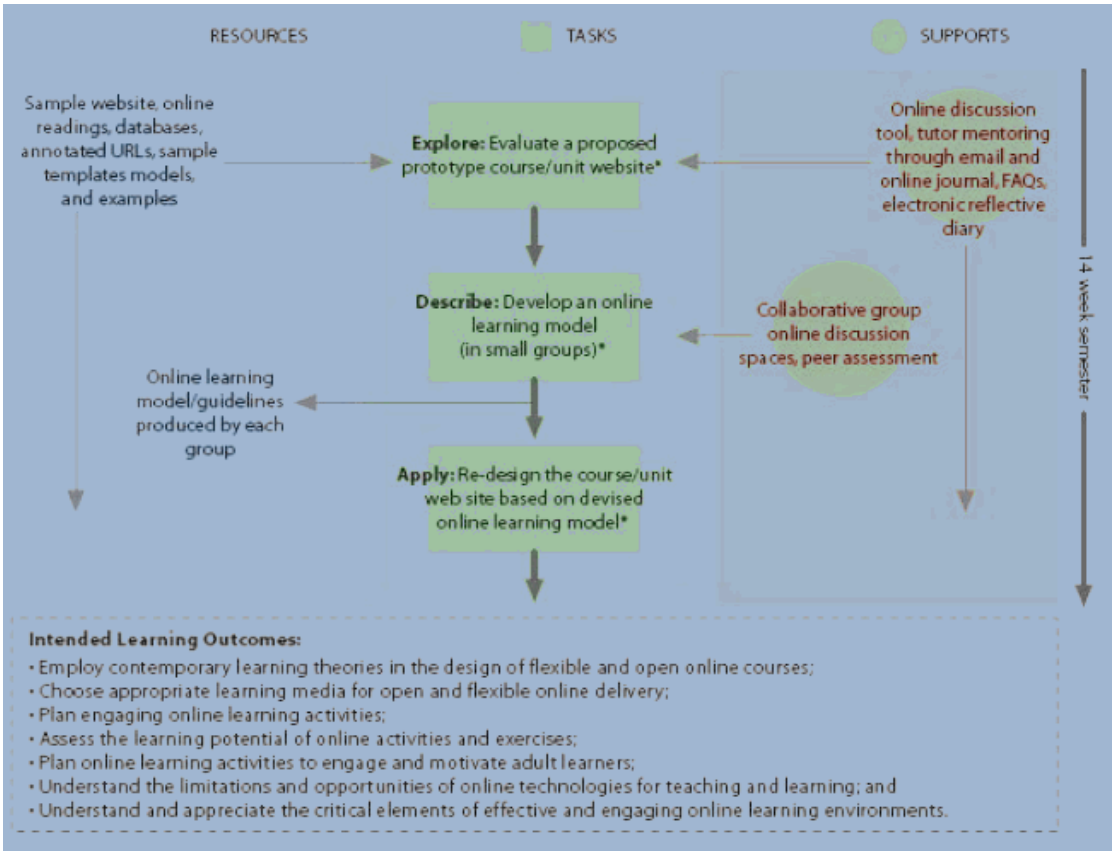

Figure 5: Example of the visual learning design representation devised in the AUTC learning designs project (Herrington & Oliver, 2002)

Discussion

A majority of the students (92%) found the Generic Design Templates simple to understand and the consistent design symbols and language would facilitated re-use (87%). However, many of those surveyed were concerned the product of their efforts was simply "paperwork" (79%), ie. this system did not produce machine-readable activities. The detail in the exemplars was regarded as "inspirational" and prompted many to try a new learning strategy (67%) even though a recurring comment was the concern of re-use of generic teaching strategies could easily become boring to students (53%). While the visual overview of the Generic Design Templates did not rate comment as often as it did with the LAMS example, it is considered by some as a very helpful feature (51%).

Conclusion

IMS-LD, LAMS and the AUTC Learning Design Project are three developments where a comprehensive system is being produced that utilises a consistent data standard and vocabulary to describe the teaching and learning environment and the different theoretical approaches employed (Oliver & Littlejohn, 2006). As reported in this paper, a majority of surveyed students identified the cross-platform operability feature of IMS-LD as a highly desirable characteristic of any learning design documentation system. Yet without XML expertise, any attempt to describe a learning design as IMS-LD was arduous and time-consuming; and, for our pre-service teachers, mostly unsuccessful. All students surveyed agreed the product of their LAMS design was a workable machine-readable activity and all but one student was able to describe a learning activity satisfactorily as a working LAMS sequence. Most students found the AUTC Generic Design Templates simple to understand and the consistent design symbols and language would facilitate re-use. However, many of those surveyed were concerned the product of their efforts was simply "paperwork" documentation, that is, unlike the other systems, this one did not produce machine-readable activities.

Clearly, a system that can comprehensively describe successful, stimulating and engaging learning designs so that they can be shared and re-used is still beyond the reach of the average pre-service teacher. However, even though the approach of each of the three examples previously described is quite different, all have features that illustrate that the dream of an easy-to-use, machine-readable and comprehensive

learning design documentation system that would enable educators to select a learning design to suit their context “off the shelf” and plug-and-play it may not be too far away.

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