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Patterns, designs and activities: unifying descriptions of learning structures

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Patterns, designs and activities: unifying descriptions of learning structures

Patrick McAndrew*

The Open University, Institute of Educational Technology, Walton Hall, Milton Keynes. MK7 6AA, UK

E-mail: P.McAndrew@open.ac.uk

Peter Goodyear

CoCo, Faculty of Education and Social Work (A35), University of Sydney, Sydney. NSW 2006.

E-mail: P.Goodyear@edfac.usyd.edu.au

James Dalziel

Macquarie E-Learning Centre of Excellence (MELCOE), C/- Library, Room 212D, Macquarie University. NSW 2109, Australia.

E-mail: james@melcoe.mq.edu.au

* Corresponding author

Abstract: In this paper we examine emerging ways to describe and structure learning material, learning tasks and learning situations. In particular, we consider three different approaches, looking at common issues and differences in emphasis. The approaches are: learning patterns [1], inspired by the architectural patterns of Alexander [2]; learning design, as described in the IMS Learning Design specification [3], which itself draws on Educational Modelling Language developed at the Open University of the Netherlands; and, learning activities as used in the Learning Activity Management System [4].

Biographical notes: Patrick McAndrew is a senior lecturer in the Institute of Educational Technology at The Open University where he teaches and researches in the use of technology in support of learning. His work examines ways to design for active engagement by learners working together. This has involved studies in task based approaches to learning and their representation as learning designs within knowledge sharing environments. In 2001 he co-founded the UserLab research team which works within the Computers and Learning research group to undertake projects in e-learning.

Peter Goodyear joined the University of Sydney as Professor of Education in March 2003 to join in the formation of the CoCo Research Centre. Prior to this, he was the founding director of CSALT (the Centre for Studies in Advanced

Learning Technology) at Lancaster University in the UK. Peter has been carrying out research and teaching in the area of ICT & Learning since 1980. His research consists of three main strands: the design and management of technology-enhanced learning environments; exploratory and collaborative learning with the aid of ICT; and, teaching with ICT: especially examining teachers' pedagogical knowledge and beliefs.

James Dalziel is one of Australia's leading e-learning innovators. He was involved in early e-learning innovation at the University of Sydney in 1996 and 1997, leading to the spin-off of WebMCQ Pty Ltd, a highly successful Australian e-learning company. After several years working across education, corporate and government e-learning, James returned to an academic environment at Macquarie University during 2003 to become Professor of Learning Technology and Director of the Macquarie E-learning Centre of Excellence. James is well known nationally and internationally for his innovative developments in e-learning and his contributions to e-learning standards.

1 Introduction

This paper looks at three lines of work on the representation of learning materials, learning tasks and learning situations, with a particular emphasis on the ability to share designs and design ideas. The three approaches are:

the use of *Learning Patterns*, inspired by work in architecture and town planning [5],

IMS Learning Design, building on work on Educational Modelling Language [6], and

work on Learning Activity Management Systems (*LAMS*), itself inspired by the IMS Learning Design approach, but introducing new ideas and already showing signs of success in engaging the teaching community.

(In this paper we follow the convention of Britain [7] in distinguishing between the general theory of learning design (lower case 'l' and 'd'), and the particular implementation of the general theory of learning design represented by the IMS Learning Design specification (capital 'L' and 'D').)

Each of the three approaches has its own merits. They also have a common goal of encouraging the development of descriptions that are useful to the original creators of learning material as well as to other people who might want to re-use or adapt such learning materials and/or the underpinning design ideas [8]. One function of our review is to evaluate the extent to which this might be achievable, given the characteristics and experiences of the approaches described. Differences in context mean that there will always be compromises in trying to share designs for learning. Understanding the nature and causes of such compromises will itself help us improve approaches to describing learning structures that involve resources, activities and roles for different people.

The use of online and electronic systems to support learning - e-learning - is emerging as a field with new opportunities and new problems. In some cases these are reincarnations of issues which are familiar in either distance or face-to-face learning situations. In other cases, the issues appear unique to the situation created by introducing

ICT into teaching. However, it is also becoming clear that the introduction of ICT offers rich, new opportunities to use and share structured descriptions of learning materials as well as transferable and reproducible digital objects (learning objects, etc). Opportunities that are discussed in this new context include personalisation [9], large scale digital repositories [10], and flexible reuse within a new knowledge economy [11].

Some of the technical and human complexities of exploiting these opportunities have been identified in work on Learning Objects (e.g. Sloep [12]). Learning Objects, broadly defined as *"… any entity, digital or non-digital, that can be used, re-used, or referenced during technology-supported learning"* (IEEE LOM [13]) have been criticised as being hard to work with and difficult to move from one educational context to another, partly because the definition encompasses all levels of object from individual images to complete courses (Wiley [14]). In practice, work in implementing Learning Objects in education (as distinct from training) tends to specialise the definition to refer to items that have educational meaning, for example units that can result in a few hours of student activity [15]. At this level the teacher can apply creative design work and the learner can engage in worthwhile activity. Working with structured material also implies a broadening of focus from resources as content to a more comprehensive conception of design.

The three approaches we consider in this paper reflect ways to support a greater focus on the representation of the learner's activity rather than the description of the resources.

The concept of patterns applied to learning seeks to identify what can be provided as useful background, guidance and illustration in describing a set of inter-related descriptions for ways to assist learning online. Patterns are not viewed as something that can be reused directly but rather as something that can provide the informed teacher with 'rules of thumb' as they build up their own range of tasks, tools or materials that draw on a collected body of experience.

The new specification of IMS Learning Design [3], while being overall neutral towards scale and pedagogic use, is well suited to structural descriptions of tasks and has generated renewed interest in what can be developed, described, and potentially reused. In the specification a formal language is described for encoding units of learning and tools, and practice in the use of this formal language is starting to be developed.

The Learning Activity Management System (LAMS) has drawn on the idea of representing designs and the learning tools needed to support learner activity to provide an integrated solution. LAMS as a software system encourages the design of sequences of collaborative activities that use individual activity tools configured using a visual 'drag and drop' interface. It also embodies an approach that values previous experience and offers an interface that encourages adjustments and easy customisation.

In this paper therefore we review these three approaches. We first consider the position of patterns and how they can inform ways to record educational designs, then review the IMS Learning Design specification and discuss the possible ways to apply it. We also examine the authoring process for designs by looking at the experience of the Learning Activity Management System in providing tools to support collaborative interactions, and the overall sequencing of these tools into designs. Drawing on this background in the three areas we then seek to unify the work by considering the requirements for reuse of designs, and the different characteristics from each approach. This is illustrated by applying each approach to describing similar learning tasks. In our view a possible coming together emerges within an architecture drawing on the LAMS work that values the strengths in patterns as a model for sharing educational designs, with

learning design supplying a more formal description that can be used within computer systems.

2   Learning Patterns

The original ideas for patterns and pattern languages come from the writings of Christopher Alexander on architecture and town-planning - see, for example, [2, 5]. Alexander's intention was to democratise architecture and town-planning by offering a set of conceptual resources that ordinary people could use in shaping or reshaping their environment. His work provides a principled, structured but flexible resource for vernacular design that balances rigour and prescriptiveness by offering useful design guidance without constraining creativity.

Alexandrian patterns [2] have the structure shown below (adapted from Goodyear et al. [1]). Variants on this structure have been used in the E-LEN project (http://www2.tisip.no/E-LEN/) and elsewhere, but the fundamental principles are the same (see e.g. Avgeriou et al., [16]).

> i) A picture (showing an archetypal example of the pattern).
>
> ii) An introductory paragraph setting the **context** for the pattern (explaining how it helps to complete some larger patterns).
>
> iii) Problem **headline**, to give the essence of the problem in one or two sentences.
>
> iv) The **body** of the problem (its empirical background, evidence for its validity, examples of different ways the pattern can be manifested).
>
> v) The **solution**. Stated as an instruction, so that you know what to do to build the pattern.
>
> vi) A diagrammatic representation of the solution.
>
> vii) A paragraph linking the pattern to the smaller patterns which are needed to complete and embellish it.

The notion of design patterns has been picked up more recently within the field of software engineering - where it has been used to capture and share aspects of software engineering experience and as a way of representing successful models for the implementation of information systems (for example in Gamma et al., [17]). Teachers of software engineering have also been experimenting with the idea of pedagogical patterns and educational technologists have been trying to apply a pattern-based approach to working on problems such as learning object descriptions, inter-operability, learning management standards, etc. [18, 19, 20, 16].

In reviewing design patterns it is useful to go back to Alexander's work to see what is distinctive about the pattern-based approach; what it can offer with respect to designing for learning.

Design patterns have a number of qualities which, in combination, give them the potential to be a useful way of sharing experience in the field of educational design. A pattern is a solution to a recurrent problem in a context. In Alexander's own words, a pattern "describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice" ([2], p.x).

Patterns, designs and activities

Context is important in helping constrain and communicate the nature of both problem and solution. Describing the context for the problem and its solution avoids over-generalisation. In addition, patterns should also teach. They should be written in such a way that they help the reader understand enough about a problem and solution that they can adapt the problem description and solution to meet their own needs. The rationale for the pattern helps with this teaching or explanatory function. Ideally, the name of the pattern should crystallise a valued element of design experience and help relate it to other design elements such that we can create and use a pattern language. The use of patterns, then, can be seen as a way of bridging between theory, empirical evidence and experience (on the one hand) and the practical problems of design.

In communities that have adopted the pattern approach, design patterns are usually drafted, shared, critiqued and refined through an extended process of collaboration. Thus patterns have the potential to make a major contribution to the sharing of techniques between developers of learning activities.

A further aspect of the pattern-based approach that needs to be considered in evaluating its potential is the embedded image of how design should take place. In short, the image of design is as what Donald Schön called a 'conversation with materials' [21]. Educational design needs to be seen as a *process* in which a designer makes a number of more or less tentative design commitments, reflecting on the emerging design/artefact and retracting, weakening or strengthening commitments from time to time. The designer's focus of attention shifts from one aspect of the emerging design/artefact to another – the cognitive load of attending to all aspects of a design simultaneously is just too great. Yet the interdependencies between design components mean that each cannot be dealt with in isolation. Supporting this process of commitment and reflection are design patterns. These patterns exist on paper (as in a book of educational design patterns) and – in some form – in the mind of the designer. In an important sense, the patterns also exist in the emerging design. Understanding the dynamic interplay between patterns in the mind and patterns in the world is key to seeing how and why design patterns work as aids to design. It is their 'fit' with the mind and the world that gives them power.

In the learning domain we consider that patterns can apply at different levels. For example to the learner it is important to have viable patterns of assessment that go across the courses they are undertaking, not just within them; too often assignment deadlines fall together as their coordination is hindered by different areas of responsibility and the combinations of choice available. This problem and possible solutions can be considered through patterns. The focus for our work is in task design, as this has the strongest analogy with the built environment where patterns are used to build concrete objects that activity then flows around in a way that cannot be entirely predicted. We see tasks designed for learning similarly as capable of instantiation in particular contexts, as illustrated in Figure 1, however the actual activity that flows will be determined by the learner's use of the task, their situation and their community and so can only be suggested by the designer rather than prescribed.
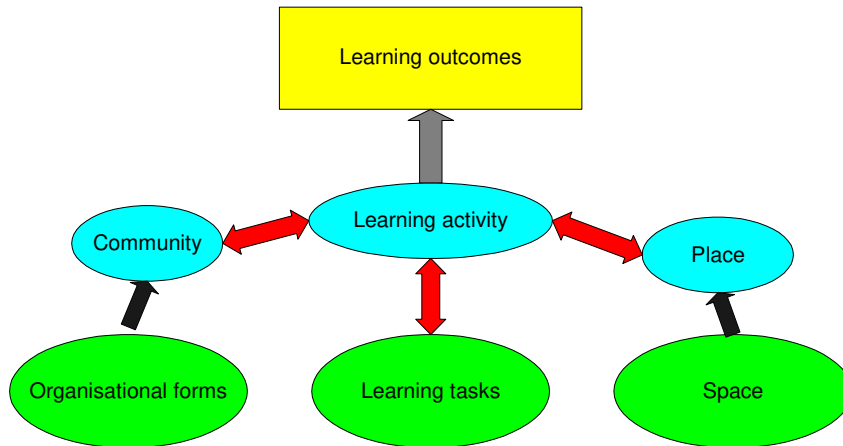
Figure 1: Designing for networked learning (adapted from Goodyear, [22]).

3   The IMS Learning Design specification

The IMS Learning Design specification [3] is a development of the Educational Modelling Language (EML) [6] designed by the Open Universiteit in the Netherlands to enable flexible representation of the elements within online courses; not just the materials but also the order in which activities take place, the roles that people undertake, key criteria for progression, and the services needed for presentation to learners. The IMS Learning Design specification does not detail how the course material itself is represented but rather how to package up the overall information into a structure that is modelled on a play, with acts, roles (actors) and resources. The work was developed into a specification through collaboration within IMS to address the need for a more structured approach to representing learning. As such it develops from the concept of Content Packaging [23], where different digital objects are gathered together with a manifest describing their location, but enhances the approach to give an ordered presentation of the different entities within the unit of learning. IMS Learning Design is intended to support all pedagogies but it brings particular strength over other approaches, such as simple sequencing [24] by enabling the representation of collaborative activities that involve different roles for learners and tutors and need synchronisation in various ways.

IMS Learning Design draws on the analogy of a play, which will have roles and may have separate acts. In the specification there is a distinction made between three levels of Learning Design:

- Level A: uses roles, acts and the environment.

- Level B: adds properties and conditions.

- Level C: adds notification and messaging.

Even at the simplest level A IMS Learning Design has the power to describe complex collaborative tasks with multiple roles and use of different tools from the environment, however level B allows variations in the flow of the activities and persistence of information about learner performance. Level C brings in the opportunities for greater personalisation and adjustment of the flow of work for different circumstances.

Steps in building a Learning Design are described in IMS Learning Design Best Practice and Implementation Guide [3], and include:

- A use case narrative.

- UML representation of activities

- XML instance using the IMS Learning Design Schema.

- Producing the XML instance in turn requires identification of:

- Title.

- Learning objectives

- Components: roles, properties, activities and environment.

- Method: the play, acts and roles.

In building the Learning Design it is possible to refer to separate objects for the end resources and for some of the required information, for example the learning objectives may be held in a separate file. These elements can then be aggregated together to transport or run the complete design. Even with this separation preparing valid IMS Learning Designs has so far been a complex process and very few validated designs have emerged in the first year since release of the specification.

3.1 Implementing IMS Learning Design

Initial work on implementation led by the OUNL has considered ways to validate the formal IMS Learning Design descriptions and add in the extra information needed to run the system. Other work (e.g. Reload, Alfanet) has started to examine the need to provide authoring/editing systems and integrate this with other tools and build up a community of practice (e.g. the UNFOLD project, http://www.unfold-project.net/). In a joint project between the Open University UK and OUNL an architecture has been designed for bringing the OUNL IMS Learning Design Engine (CopperCore) together with other services to provide an overall IMS Learning Design Player using the architecture shown in Figure 2.
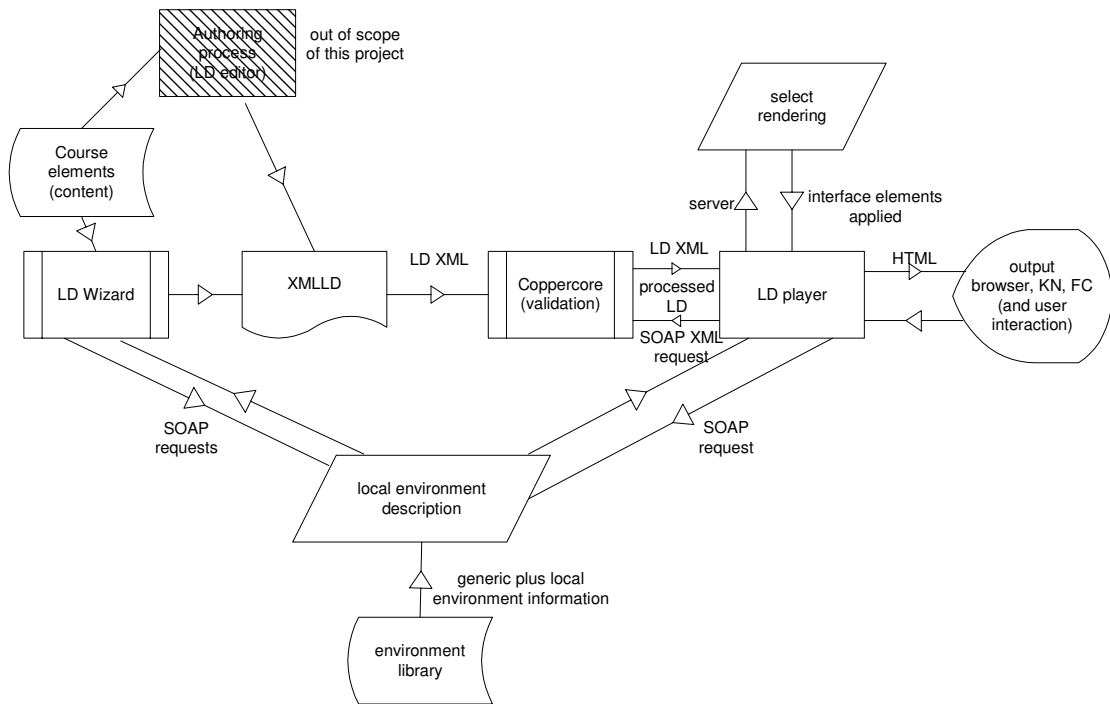
Figure 2: Architecture for an IMS Learning Design Player

A key element in this architecture is the provision of an environment description service. This appears in the diagram both in the authoring aspect and the delivery. Essentially what is needed are generic descriptions of the pedagogic service required, for example an asynchronous discussion system may need to be able to track different threads, support email access, have moderation and delegation to tutors. If activities are to be transferable then such generic descriptions in the design need to be matched back to available tools in the player. Otherwise learning design becomes a way to encode particular implementations without abstraction or full capability to be reused. Generic services are therefore not a direct requirement of IMS Learning Design itself but are needed if it is to meet the demand for reusable designs. Working with IMS Learning Design has also highlighted the need for ways to simplify the production of designs. In Figure 2 this is shown by the "LD Wizard" as a way to take existing designs that have been crafted into XML representations (following the approach described above) and produce a template allowing variations on the original design to be generated. There is a clear need for such a tool to simplify working with formal designs but its full capabilities and user requirements needs to be determined with regard to the lessons and experience from other approaches.

4   Experience from LAMS

The Learning Activity Management System (LAMS) is a functioning software system building on the theoretical basis of learning design of "*people doing activities with*

resources" (e.g., Sloep, [25]). LAMS has been in use with teachers and students since mid 2003, and at the time of writing (mid 2004) is nearing the end of its beta development period. The development of LAMS has been based on learning design theory, and in part on the IMS Learning Design specification.

The development was driven by a specific example of a sequence of activities to be authored and run using the LAMS learning design software (a "use case"). The sequence was designed to be appropriate for a secondary level school history curriculum (ages 12-17), based on the question "What is Greatness?". The purpose of the sequence was not only to teach students about great people from history and the qualities that made them great, but more importantly to get students to engage in a dialogue with their peers about the concept of greatness, and to "stretch" their own understanding of the concept of greatness as a result of this dialogue.

From a technical perspective, the design goal was to build a system that was able to be adapted for use in a very wide range of pedagogical contexts, including the specific context required by the "What is Greatness?" use case.

4.1 The "What is Greatness?" use case

The initial "What is Greatness?" use case had nine main steps in the activity sequence. To simply this for audiences who were new to the concept of learning design, this was later modified and reduced to five steps. The shortened version of "What is Greatness?" is described in [4], and this has become a paradigm example for many audiences in gaining a first understanding of learning design in practice. For completeness, the full "What is Greatness?" sequence is presented below (this is slightly revised from a version of the use case submitted to the Valkenburg group (http://www.valkenburggroup.org/) in October 2002):

Step 1: Students individually consider the question "In your opinion, what is greatness?"

Each student clicks on a link to start the learning activity sequence, and then reads the question and types his/her response into a text entry box. The responses are collated by the system for presentation to all students in the next step.

Step 2: All students see all responses to the previous question (anonymous).

Each student is presented with all answers in an anonymous format, and is asked to consider how his/her own answer differs from other students. Students are provided with a text entry box which links to their private learning journal (not seen by others). They are instructed to choose any ideas they think are interesting and to add them to their journal together with any other personal reflections (the journal provides the basis for an assessable report - step 9).

Step 3: Students are asked to choose up to 5 "great people" from a list of 20.

Students individually select up to 5 people from a list of 20 great people presented by the system based on a list prepared earlier by the teacher. Students can also add one of own via a text entry box. The system collates the "votes" for presentation in the next step.

Step 4: All students see collated votes.

Students are presented with a screen showing collated votes from the previous step (plus any text entry additions). Students are instructed to make notes in their journal about how their own votes compare to the collated class response.

Step 5: Students are divided into small groups.

The system randomly allocates students into small groups, e.g. 4 groups of 5 for a class of 20.

Step 6: Small group discussion board

Each small group is given its own private (asynchronous) discussion board, which is structured to support directed exploration of "greatness", together with links to relevant content (see step 7 below).

Step 7: Review content

While in the discussion area, each group is given content about greatness to consider.

The content may be delivered via URL links, teacher uploaded websites or individual files. Steps 6 and 7 would take place together over an extended period (e.g., a week)

Step 8: Small group live chat and scribe

Each group meets for 20 minutes in a live chat room to debate questions set for them by the teacher. During the debate, a scribe enters text under guidance from the group, but the text is not submitted until all group members click an "agree" button. The following page shows the agreed text from each of the four small groups presented on one page to allow for comparison.

Step 9: Each student writes a report, and submits it to the teacher.

Each student completes an assessable report based on all the activities and their journal entries. Once complete, the report is uploaded to the system, which then forwards it to the teacher for grading and feedback. The sequence is finished once the teacher completes the marking process and instructs the system to release all grades and feedback to the students.

By way of comparison, the simplified version omitted the first four steps entirely, and slightly changed the order and activities for the remaining five steps (see Dalziel (2003) for details).

LAMS was not created only to run the example given above – it was designed to allow considerable flexibility in both the content and structure of learning designs. Taking the example given, the content of this activity could easily be changed to another topic (e.g., What is Jazz? What is a Hero? What is Ethics? etc.) by changing the content elements such as the question, voting categories, resources, etc. One of the striking features of LAMS is the speed at which new sequences can be created from an initial structure – if a teacher had already selected the new content needed for, say, "What is Jazz?" (content such as composers to vote on, jazz compositions to listen to, etc), then the process of changing "What is Greatness?" into "What is Jazz?" would normally take 5-10 minutes.

The second type of flexibility comes from the ability to change the structure of a sequence. Again taking the example given, a teacher may decide to reverse the order of the initial question & answers and voting tasks, and perhaps include some new content at the very start of the sequence to introduce the topic. Changes to the sequence structure are achieved via a simple drag and drop interface in which existing activities can be

dragged into new locations, and new activities dragged into the sequence at an appropriate point. As with content changes restructuring can also be completed very quickly – to make the changes described would normally take less than a minute. If we were to combine these structural changes with the content changes described above, we could produce a new sequence with both different content and a different activity structure in less than 10 minutes.

LAMS offers a complete system in three parts where first a design is produced in the *author* environment, using a visual sequence editor, then designs are instantiated with a particular class group (and subsequently tracked) through the *monitor* environment, and then designs are accessed by students from the *learner* environment. The modularity of the system allows each environment to be considered in its own right (not just as a unified whole), and particular focus has been placed on the *author* environment as a way to engage teachers in designing activities for their courses. The potential exists to separate out the environments by offering advice and models during authoring and to represent the resulting designs so that they can run in other learning support systems, provided they use the same structure to represent sequences and activities.

5   Unifying the concepts

The discussion of each of design patterns, learning design and LAMS has similarities and potential overlaps. In each case there is a sense in which their application is neutral and they may be exploited in a variety of ways. In this section we offer a choice of ways in which they might fit together depending on the dominant requirement – for example aiding delivery to learners, guiding teachers, validating and assessing designs.

5.1   Requirements discussion

The LAMS software shows that teachers can engage with a way of representing and running sequences of tasks within an environment. It offers a set of tools and the ability to link them together. However what is unclear is the way in which good designs will emerge; the software itself will run valid sequences whether or not they encourage appropriate models of learning or constitute sensible learning tasks. From initial work using LAMS there do appear to be common sequences that are adopted in different situations; i.e. there are emergent patterns of use that may relate to design patterns.

The LAMS experience suggests a possible hierarchy for the use of the pattern description as a guide towards developing and running implementations.
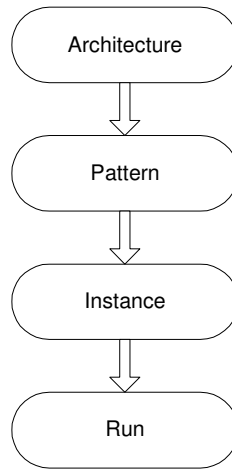
Figure 3: A possible relationship between aspects of designing learning systems.

Table 1 draws a comparison across the three approaches against various questions and issues that need to be tackled when developing shareable designs. This table represents the result of a brainstorming session drawing both on the reality of current implementations and the expected direction for developments. In each case there is considerable flexibility in possible interpretation and so this table shows the authors' consensus rather than the only possible view. The emergent view from constructing the table is that IMS Learning Design and LAMS approaches have many similarities (indicated in the characteristics section of the table), with differences mainly in the tool sets currently used and the restrictions placed in LAMS from the experience of implementation. The Pattern approach however has significant philosophical differences in expecting the user to engage fully with the pattern before using it, and deliberately leaving some implementation aspects vague. This is an important guide in reviewing the other approaches, which could diverge in implementation depending on the primary target needs the development community seeks to address. The audience for such tools can be considered at two extremes:

1. If the aim is to provide a rigorous tool for technical users to share structured representations, then IMS Learning Design offers a way in which designs can be encoded and will in the future provide access to players to then run the designs, while LAMS provides such a run-time environment but has a specific set of tools and flows that can be encoded during authoring. An ideal solution could then be convergence of these two technologies with refinements in the way tool sets can be described. At this extreme a library of educational entities can be imagined that can be selected and run in a seamless manner, interoperating with a variety of platforms and technologies.

2. If the aim is to value the input of pedagogical experts and give them a way to exchange ideas and to broaden the range of academics using challenging approaches that have a theoretical and practical basis, then the patterns approach is likely to engage these audiences through providing accessible descriptions that also require flexibility in implementation. In setting the

agenda for architectural patterns Alexander suggested "A pattern language gives each person who uses it, the power to create an infinite variety of new and unique buildings, just as his ordinary language gives him the power to create an infinite variety of sentences" ([5] p167). At this extreme, immediate reuse is not desirable and descriptions should require pedagogic decisions to be apparent and taken by the academic who is reusing a pattern in learning.

As is usual in describing two extremes there is value in both approaches, and a compromise between the two positions may be the most desirable outcome. However it seems that the focus of recent work has moved towards the first of these, as the focus on reuse and encoding of specific technologies leads towards systems that have interesting technical characteristic but fail to engage the academic community. As each of the approaches is under development the model of use is not fully established and so modified forms of LAMS and IMS Learning Design may be appropriate for providing partial models for designs (as required by the patterns approach); and the patterns approach may also support use of more concrete representations.

Issue/Question	LAMS	IMS Learning Design	Patterns
Features			
Representation	Visual sequence flow & embedded text	XML & UML	Stylised sequence of expository text
How do you modify?	Rearrange visual flow and rework task text.	Rework XML/UML	Rework expository text
How do you aggregate?	Collect sequences within folders	Build bigger designs with sub units.	Create pattern language
What is missing?	Pedagogic wizard	Abstract tool definitions and operational links. Pedagogic wizard.	Learning Management System (LMS) and the expertise to get the pattern into the LMS
Users			
Who can easily understand?	Academic Practitioner with a little technical knowledge	Technically aware expert	Academic Practitioner
What is the minimal prior knowledge for use?	Some pedagogical knowledge, Some technical knowledge	Some pedagogic knowledge, high technical ability	Only pedagogically adept teachers
What does ideal use require?	More pedagogic knowledge and technical	More pedagogic knowledge and technical	Pedagogically adept teachers linked to moderate technical

	understanding	understanding	knowledge
Characteristics			
Is a creative jump necessary for implementation	No	No	Yes
Minimal complexity in design	Small	Small	Great
Ease of adaptation mid-stream with students	Hard	Hard	Easy (though depends on supporting technology)
Potential for student participation in creation of design	Limited – only possible prior to running the design.	Moderate	Extensive

Table 1: comparing issues in LAMS, IMS Learning Design, and Patterns

In the following sections we present a particular collaborative activity in each approach and then review how the representations can be brought together and influence the way forward.

5.2   The evaluation task example

The chosen example is an evaluation task where it is assumed that a group will be collaborating together to adopt various roles to carry out an analysis of provided resources and work together to consider characteristics and reach a joint judgment. Similar scenarios related to discussion based collaboration have been use cases for both LAMS and IMS Learning Design, and also considered as examples in earlier work developing patterns for networked learning.

5.2.1   IMS Learning Design

In IMS Learning Design the activities are typically built in a concrete way based on existing examples. In this case the evaluation task is a simplified version of a task description given as part of the MA in Online and Distance Education at the Open University (http://iet.open.ac.uk/courses). Students are asked to evaluate examples of multimedia in use and then discuss their merits and provide a rating for the examples against criteria that they derive.

The use case narrative

The narrative is as follows:
    Title – Multimedia examples discussion.
    Provided by – The Open University.
    Pedagogy/Type of learning – individual examination of examples linked to group debate.
    Description/Context – Students are given access to a range of multimedia examples which they can also augment through their own research. They discuss the examples and

try to identify strengths and weaknesses. Shared criteria are established and then consensus reached by the group.

Learning objectives

- An appreciation of the range of multimedia available.
- Experience in evaluating multimedia.

Roles: -

- Tutor
- Learner:
  - o Evaluator
  - o Moderator

(Note that in this particular design the learner roles need to be negotiated and are not assigned.)

Different types of learning content used – the following content is used:

- Task narrative
- CD Multimedia examples
- External web based resources
- Short papers on evaluation
- Book chapters on multimedia

Different types of learning services/facilities/tools used – The following services are needed:

- Conference – to discuss material, agree approach and for tutor to moderate.

Different types of collaborative activities – students engage in the following collaborative tasks:

- Division of provided examples
- Identification of new resources
- Discussion of strengths and weaknesses
- Identification of criteria
- Consensus on chosen examples
- Conclusion

Learning activity workflow – There are four activity structures, each comprised of a number of learning activities:

- Division of examples
  - o Identification of sample set
  - o Proposed division
  - o Agreed division
- Evaluation
  - o Reading of related articles
  - o Run through and evaluate sample software
  - o Research and locate additional samples (optional)
- Asynchronous discussion

- o Agree process
- o Contributing own example summaries
- o Reading summaries of others
- o Discuss criteria for good software

(Note that the asynchronous discussion and the individual research take place partly in parallel, so these can be seen as one activity structure, called 'research' say).

- Concluding debate/discussion
  - o Propose software with good characteristics
  - o Others review rationale and revisit examples
  - o Determine consensus/conclusion

Scenarios – additional content could be introduced or the same content could be used in face-to-face or a blended approach.

Other needs / Specific requirements – none.

The UML diagram

This will be too complex to be viewed in one diagram, with the need to represent different flows, and sub activity structures, so an example section is shown in Figure 4.
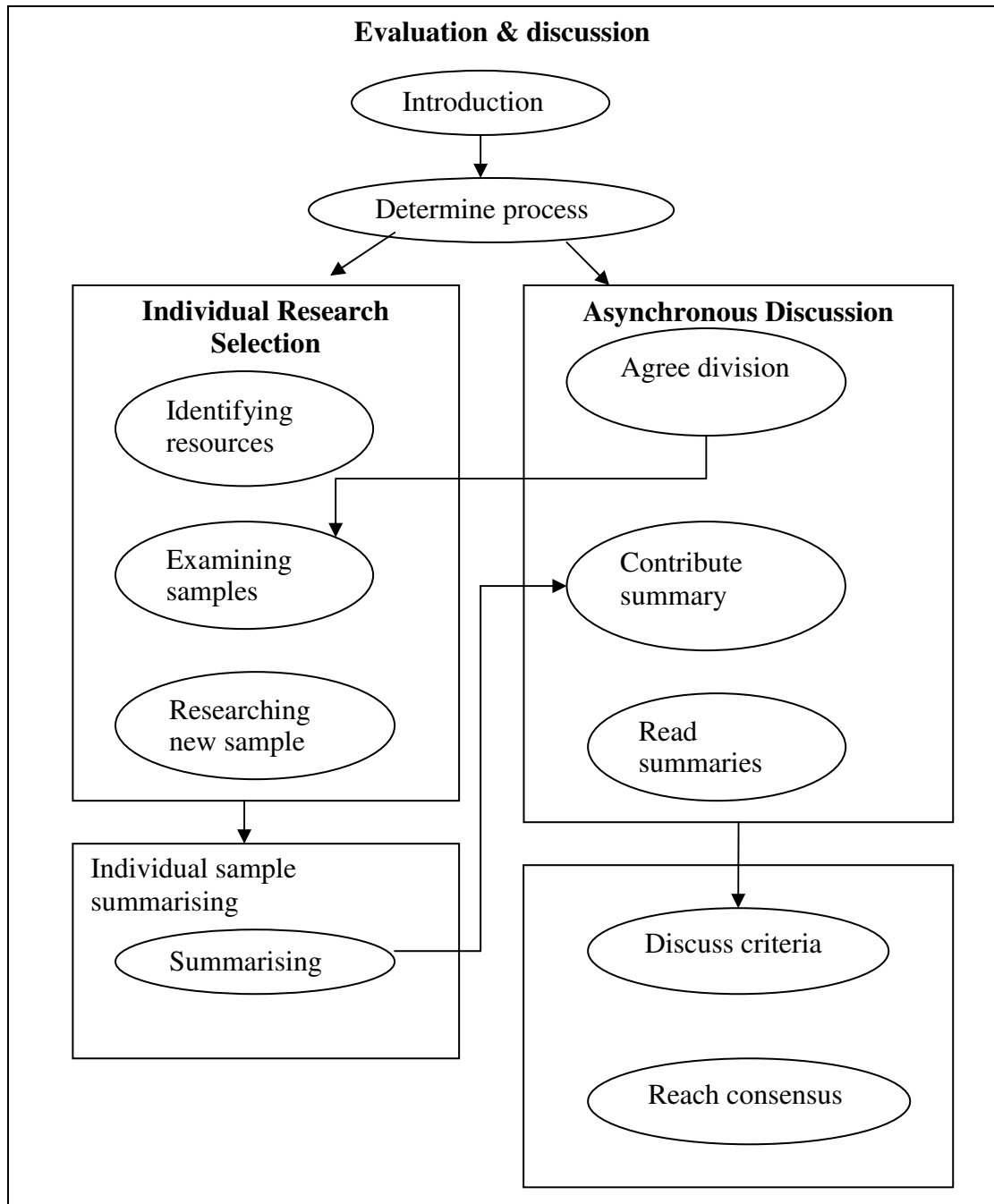
Evaluation & discussion

Introduction

Determine process

Individual Research Selection

Identifying resources

Examining samples

Researching new sample

Individual sample summarising

Summarising

Asynchronous Discussion

Agree division

Contribute summary

Read summaries

Discuss criteria

Reach consensus

Figure 4: UML representation of evaluation of multimedia

Note that the individual research and the asynchronous debate can be performed in parallel. Also the elements of these are not a straightforward sequence, as there are

optional routes through these. For example, a student will typically carry out their evaluation alongside reading about multimedia development and evaluation techniques, or they may choose to read the evaluation reports of others before they contribute their own. There are some dependencies however, for example, the student cannot report their evaluation until they have completed it and there can be no consensus reached until criteria have been discussed and sufficient samples analysed. Thus synchronisation properties are needed in the Learning Design.

There may be different versions of this diagram to represent different possibilities. The different boxes can represent different 'acts' in learning design. The Implementation Guide states that "Acts are used not only to support parallel activities… but also as synchronization points when the flow crosses roles".

The final stage in representing this task is to produce the XML, this is omitted here but it is worth noting that it is complicated to produce with current tools and the resulting representation is long. The learning design would need to take advantage of condition and properties (which makes it level B of learning design). The properties that might be required include flags to indicate when the samples have been divided, or when consensus has been reached. Conditions could be used to allow for alternative paths through the design, for example if research based criteria are introduced then evaluations may need to be reviewed.

5.3 Evaluation task using LAMS

The same example used for Learning Design has been created within the LAMS system as shown below. The LAMS flow and tools required some compromises and in order to produce a single representation some implied choices had to be made.

The authoring process involved a drag-and-drop editing that helped the author of the task appreciate and refine the structure. This shows the advantage of an accessible representation during the creative phase in editing designs.
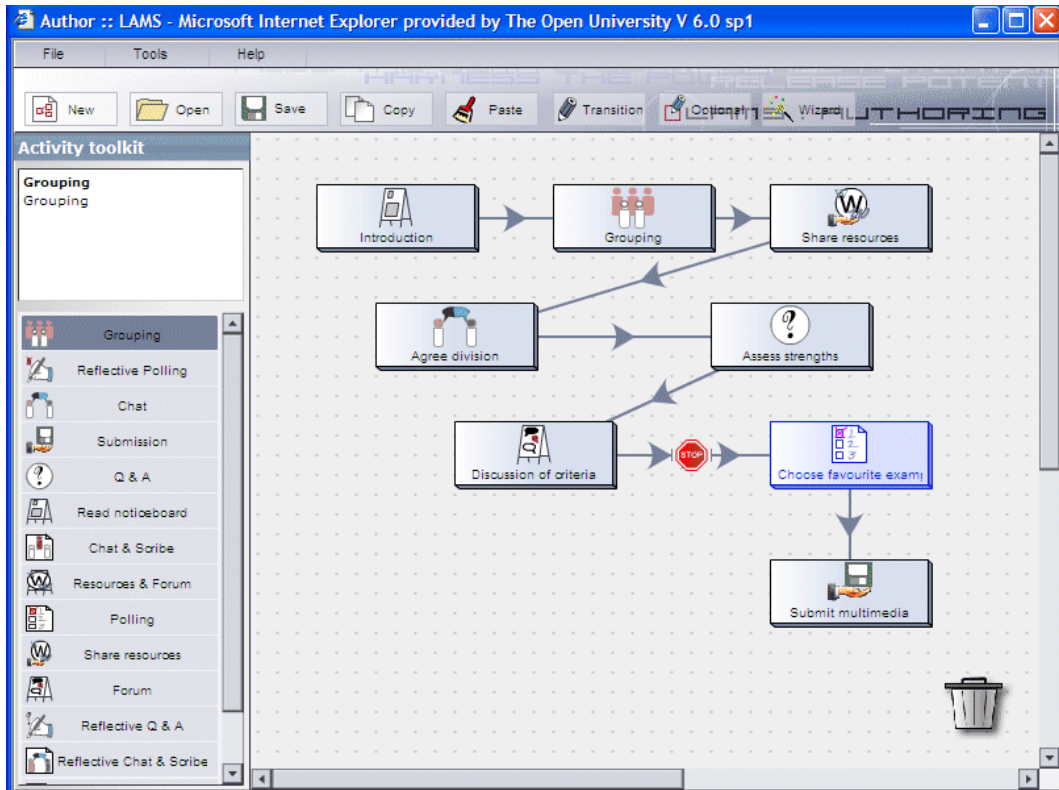
Figure 5: LAMS overview of the evaluation task

In using LAMS the initial sequence is designed and then for each of the activity tools the parameters are set. The example above shows a linear step through the activities, it is also possible to group tasks together so that they occur in parallel as is shown in the design in Figure 4, however some of the advantages of the sequencing and monitoring are reduced when using such grouped tasks. In this example each of the activities can be populated as follows.
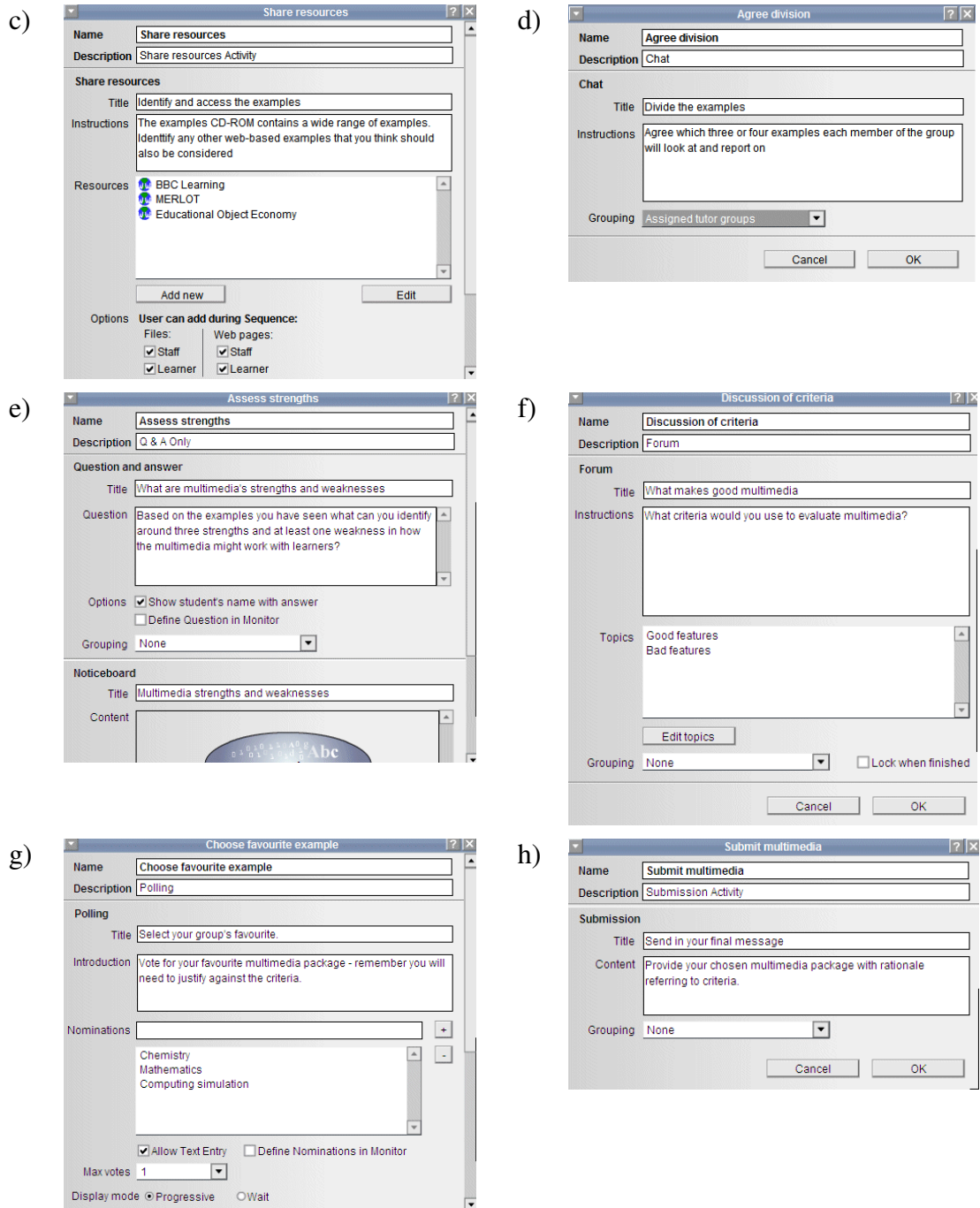
a)

b)

Figure 6 a)-h): Completion of the details for each tool in the evaluation task

The tutor has access to a monitoring view to set up the groups and also to check progress and make contributions while a group are using the system Figure 7 a). The learner's

view of the system changes as they pass through the sequence. For example when using the tool to look at web resources and to share any new sites they identify the user view is shown in Figure 7 b), they can also see their progress through the activity sequence in the left hand part of the screen shown in the figure.
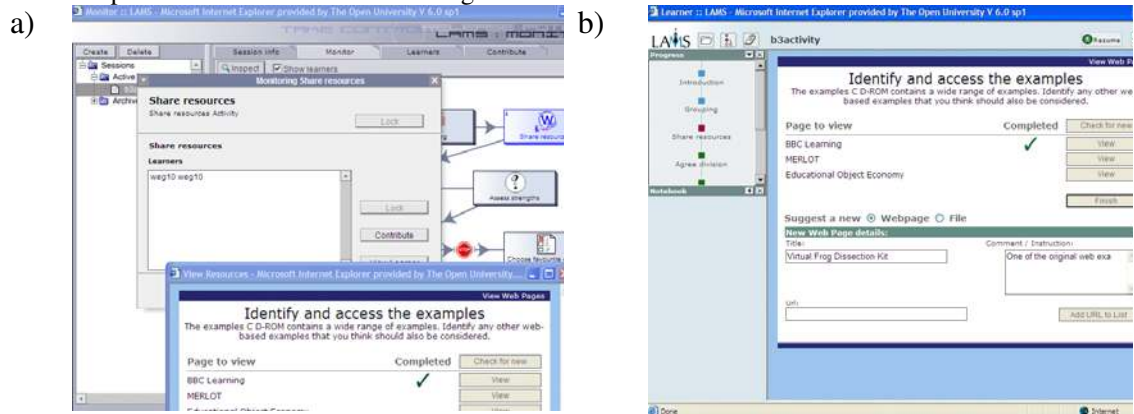
a) b)

Figure 7 a) & b): Monitor and Learner views of the evaluation task

Undoubtedly one of the strengths of the LAMS system is that it is well integrated and that each tool is well-suited to collaborative working. However this also means that the result currently can only be run on LAMS servers, as no other Learning Design system has yet implemented equivalent functionality. In the current system some flexibility is offered for the teacher to make adjustments during the run time but no direct support or advice is provided on how the sequence should be run. The model assumes that the designer and the teacher are the same individual, or where they are not, that a separate document is provided by the designer to the teacher with advice on how to facilitate the activities when they are "run" with students.

5.4   Patterns for the evaluation task

Using a patterns approach means working at a higher level of abstractions. Following the approach described by Alexander [5] patterns need to be specified for a particular context, address problems within that context, and be able to be described as a solution. For architecture a pattern language of 258 patterns was provided by the work of Alexander and others [2] and such a language needs to be constructed for learning to allow a particular pattern to draw on other patterns related to it. The gathering together of such patterns is ongoing work by several groups (e.g. Botturi & Belfer, [26], Caeiro et al., [27]) and the ELEN project has gathered together other patterns related to learning and the use of learning management systems (http://www2.tisip.no/E-LEN/) as a start towards providing an overall pattern language for learning. For the example of the evaluation task, a pattern is needed for a possible solution, in this case COLLABORATIVE EVALUATION has been developed as a possible pattern as shown in Figure 8.

Pattern: COLLABORATIVE EVALUATION
Context: A group of learners need to understand the principles behind a particular technique so that they can progress to become able to select particular implementations for others and to be able to take part in producing further examples themselves. Such

learners need to develop an appreciation of the different forms available, the structure they have and why particular forms are suitable for some tasks.

Body: The contradictory challenges in this are the need to understand the structures that have been used alongside the need to see new ways to do things. The breadth of what is available needs to be examined alongside understanding how the software might apply when used in depth. It is important to balance individual views with group views and established positions from literature and other sources.

Solution: Building a collaborative evaluation enables the sharing of the work load and brings in the views of others to enable testing of consensus and variation in the depth that each individual may look at a particular example.

It is associated with patterns for LEARNING THROUGH DISCUSSION, COLLABORATIVE LEARNING and NETWORKED LEARNING PROGRAMME. It builds on patterns for DISCUSSION GROUPS, DISCUSSION ROLE, FACILITATOR, DISCURSIVE TASK, SEARCH, and CONSENSUS FORMING.

Figure 8 Collaborative Evaluation as a Pattern

The pattern for COLLABORATIVE EVALUATION is itself dependent on other patterns, for example for a DISCUSSION GROUP. A pattern for DISCUSSION GROUP (from Goodyearet al. [1]) is shown in Figure 9. This incorporates advice and suggestions for how to proceed with the discussion. In this case this would act as a guide to the creator of the Learning Design/LAMS sequence

Pattern: Discussion group

Context: This pattern is mainly concerned with the establishment of appropriate organisational forms for knowledge-sharing, questioning and critique. It is a way of helping implement the patterns LEARNING THROUGH DISCUSSION, COLLABORATIVE LEARNING and NETWORKED LEARNING PROGRAMME.

◆◆◆

Body: Discussion groups are the most common way of organising activity in networked learning environments. The degree to which a discussion is structured, and the choice of structure, are key in determining how successfully the discussion will promote learning for the participants.

Discussions can be relatively structured or relatively unstructured, and they may also change their character over a period of time. It is not uncommon for a teacher to set up a discussion in quite a formal or structured way, and for the structure then to soften as time goes by – for example, as the participants take hold of the conversation, opening up and following new lines of interest.

The structure of a discussion should be such that it increases the likelihood of:

a) an active and substantial discussion, with plenty of on-task contributions

b) the students coming away from the discussion with a good understanding of the contributions made

c) contributions being made by all members of the group and 'listened' to by all other members of the group.

Unstructured discussions run the risks of (for example)

- not getting going properly within the time available
- dissipating into a number of loosely related strands that fail to engage effectively with subject being studied

---

- dissolving into monologues or two-way conversations that fail to involve the whole group (Wertsch, 2002) [28].

Pilkington & Walker (2003) [29] have demonstrated the value of assigning explicit group roles in online discussion groups. Some writers, for example, McConnell (2000) [30] are not sure about the validity of the teacher setting specific structuring devices, preferring to make the group itself responsible for determining how it wants to discuss things, or carry out its work more generally.

Solution: Start any online discussion by establishing its structure. Make the rules and timetable for this structure explicit to all the members of the group. Where there is little time available to the group for the discussion, and/or the members of the group are inexperienced at holding online discussions, the teacher/facilitator should set the structure. Where the students are to set their own structure, the teacher/facilitator should give them support and ideas about how to do this, and encourage them to do so in a fair and timely way.

◆◆◆

Patterns needed to complete this pattern include: DISCUSSION ROLE, FACILITATOR, DISCURSIVE TASK

Figure 9 Pattern for DISCUSSION GROUP (adapted from Goodyear et al., [1])

6 The way forward

The review above has drawn out the distinction between patterns and Learning Design/LAMS. In the ideal of patterns, flexibility and advice is valued over complete description and instantly usable output. For education there has to be a consideration of the cost of getting a design wrong; only when the teacher can understand using a design will they be able to apply intuition to avoid costly mistakes and vary a design as it runs. Work on encapsulating designs for reuse has to pay attention to this point and it is our belief that for many situations the aim is to capture good guidance and support the development of new activities rather than an exact transfer of models. We need to expect teachers to spend time working fluidly with designs rather than to pick and choose. This aim can apply to using either IMS Learning Design or in developing LAMS. In this section we will look particularly at how a future version of LAMS may vary in the facilities and user interface that it offers.

Work on the next revision of LAMS had suggested that a "LAMS authoring express" could supply models for reuse and a minor enhancement would be to support this through advice, possibly using the structures of patterns as shown in Figure 10. For example an approach reusable for "analysing a concept" can be built from the "What is Greatness?" use case. This can apply to other similar situations, e.g. considering "What is Jazz?", and in practice each use will differ depending on real class situations and the variations that happen. Knowing this, advice should be incorporated that assists teachers to identify what aspects may be considered important and what experiences in other situations can suggest.
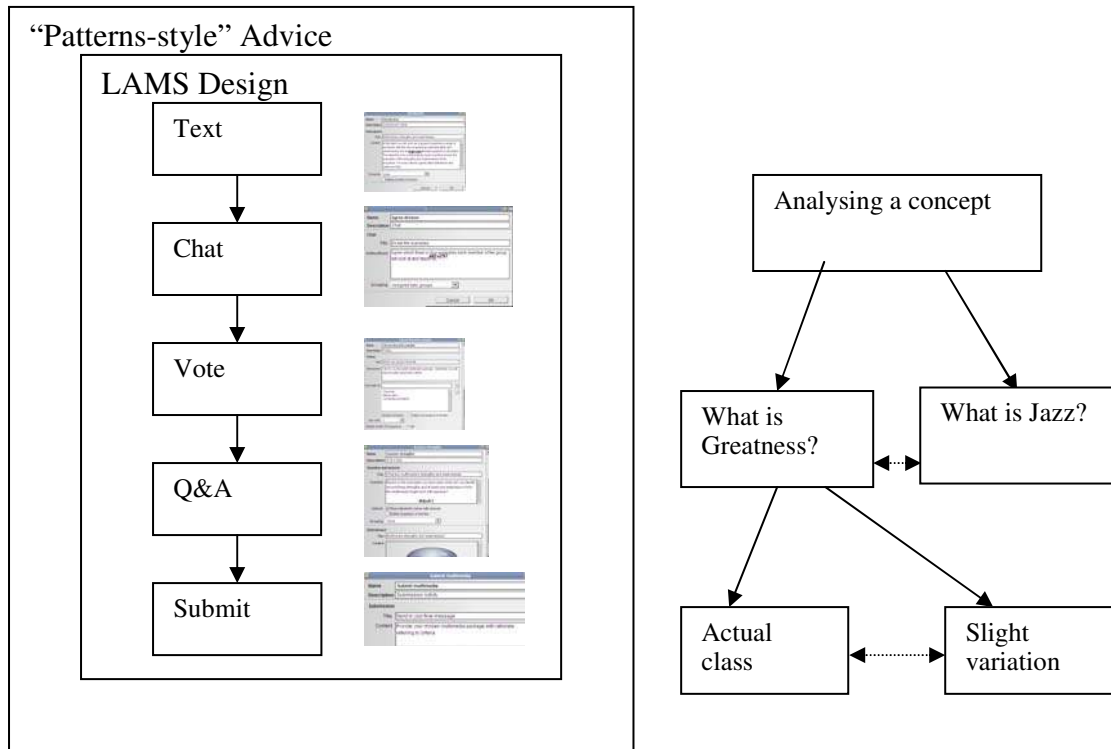
Figure 10: LAMS Authoring Express – representation of analysing a concept

Considering the approach of patterns now leads to a new view of what may best be offered. LAMS Authoring Express aims to reduce the complexity of the interface, however that can also reduce the tendency of teachers to consider new options and to understand how to cope with the flow in practice. An alternative view of how LAMS can be enhanced is shown in the architecture of Figure 11.

Advice

Metadata
…………
…………

} Compliant with standards

Pattern
…………
…………
…………

} Pattern design describing concept, summary and advice. (May be more than one)

Design/exemplars

} Design exemplars – represented as e.g. LAMS structures or IMS Learning Design Use cases. These may be partial designs or complete implementations.
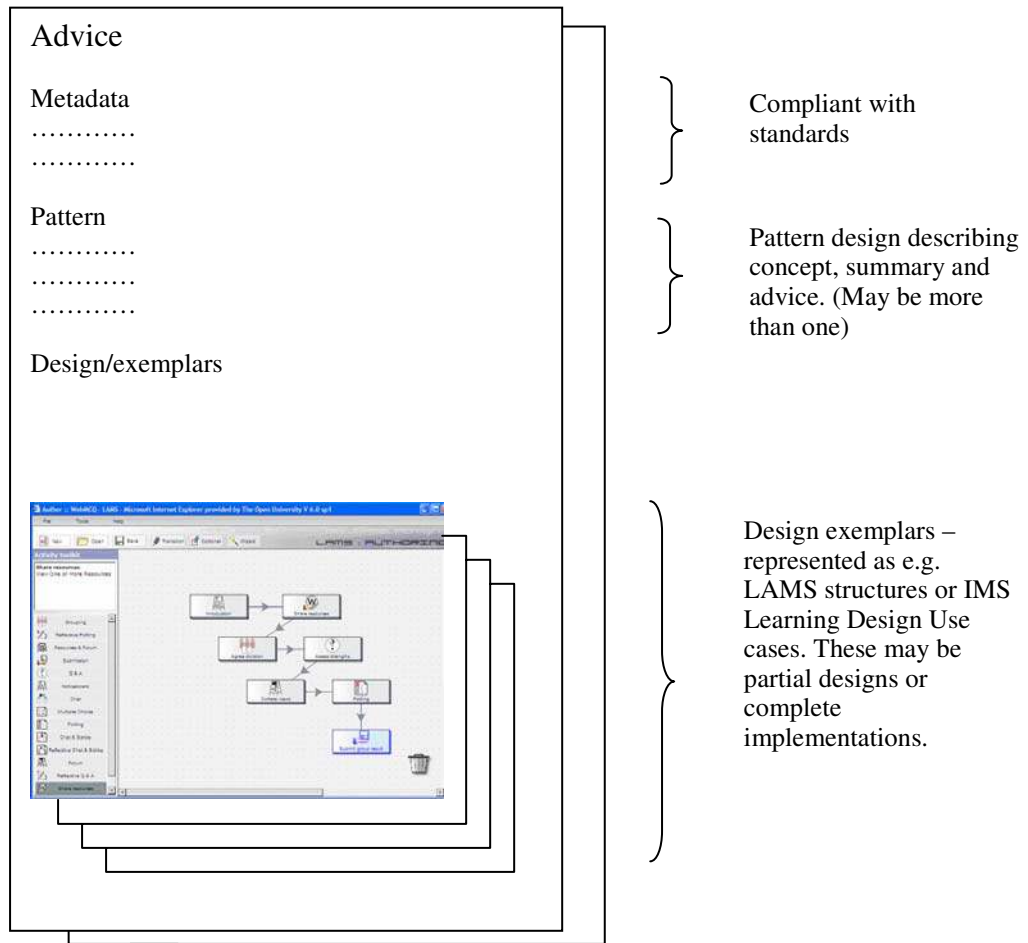
Figure 11: Framework bringing together LAMS and Patterns

In this new framework the problem of producing generic exemplars remains in that within the design exemplars there would need to be a link to specific services. The IMS Learning Design system shown earlier in Figure 2 attempts to provide access to appropriate environment descriptions through web services. By including an area for patterns within the framework, it is also possible to imagine different types of Pattern expression, hence the potential for the entire advice structure to exist in different formats. However, the paradigm provided by the Patten is **not** to provide a complete solution but rather to provide enough guidance and expect human intervention and variation in each reuse. The convergence of the work on specific representation and advice through patterns shown in Figure 11 allows us to propose a system that accommodates the advantages of both approaches without focussing only on pre-built designs/exemplars.

7   Conclusion

IMS Learning Design is a specification that has attracted a lot of interest that is beginning to be reflected in implementations. Part of that interest is driven by the promise of improving the way in which designs can be exchanged by providing an agreed representation. The discussion in this paper has reviewed both an early implementation based on the ideas behind learning design (LAMS) and the lessons from the use of patterns in design and considered how the exchange of ideas in a community needs to provide flexibility. If implementations focus on using IMS Learning Design to provide completely specified exchangeable elements in learning management systems then this will certainly be of value, but may not provide significant support for exchange of understanding and reuse in a that recognises adjustment to context and draws on the skills of both the original designer and those of the teacher involved in the reuse.

A consequence of the ease of use in LAMS in providing a sketch of a design is evidence that teachers can engage with designs, but it also has shown up challenges in how best to support reuse and allow designs to be generalised. Our work suggests that in the further development of LAMS and IMS Learning Design we need to draw on the experience of patterns to address the production of flexible models for reuse. The framework we suggest uses patterns as a formalism to capture advice around more specific examples produced with LAMS or stored in IMS Learning Design.

In our discussion we feel that the development of reusable educational components is now at a very important point where many specifications have been agreed and web based technologies, such as web services, support a distributed model for sharing. Reflection is now needed about the best ways for the education community to build on this opportunity.

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