

LADiE Project Final Report

Learning Activity Design in Education (LADiE)

Reference Model project.

April 2006

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Executive Summary

The project philosophy was to create a reference model covering learning activities rooted in practice, that was informed by effective approaches to teaching and learning and that was expressed in a well defined vocabulary which could be understood by all stakeholders with an interest in the reference model. Furthermore it was important that the reference model should be independent of proprietary software, ensuring flexibility and timeliness.

The LADiE project used a 3-layer approach as a means of bridging the gap between practitioners and technical developers. The 'top end' consisted of the teachers or practitioners, but may or may not have technical expertise, but whose primary concern is teaching and pedagogy. At the 'bottom end' are technical developers, who are conversant in technology, but have little or no interaction with a teaching environment. In the centre are learning technologists, who are involved with designing and implementing solutions for teachers. The project aimed to develop a shared language for these groups to communicate with each other in an unambiguous language.

The particular strength of the project was that the project team consisted of individuals with both pedagogical and technical expertise. The team was essentially divided into a pedagogical and a technical team and work packages were led by one of the teams, but cross checked by the other. The initial task was to undertake technical and pedagogical reviews to explore existing e-learning pedagogies and technologies and to inform the next stages of the project. The literature review from the 'top down'/pedagogical team can be found at www.elframework.org/refmodels/ladie. The 'bottom up'/technical team produced 3 internal reports, in conjunction with a technical associates meeting, to define existing technology and applications and areas of overlap between these systems.

The next stage of the project was to gather learning activities through a series of practitioner workshops. The reviews highlight key current technical and pedagogical developments in designing for learning and informed the initial development of the workshop materials. Use was also made of previous materials, such as templates developed by Intrallect for gathering use cases and the DialogPlus learning activity taxonomy. Three workshops were run (two in Scotland and one in Southampton) with a total of 28 participants. Participants were gathered from across FE and HE and consisted of both teaching and support staff (generally with some remit in terms of supporting the implementation of learning technologies). A series of learning activities were produced from the workshops, which were then translated into more technical use cases. The bottom-up team worked with the top down team in translating the learning activities gathered in the workshops into 'use cases'. These were subsequently mapped onto existing interoperability standards and specifications by the technical team to provide a basis for the reference model. The LADIE architecture was defined from the use cases developed, which explored further the technical domain of the reference model. A draft 'reference model' was developed which was discussed in detail at a technical associates meeting in February 2006. The focus of the reference model was discussed and recommendations made. From these discussions, the implementation and services guides were produced, and the architecture refined. A pedagogy guide was developed to map against both the technical and implementation guides and also against the requirements gathering process.

A gap analysis identified the pedagogic focus of LADIE use cases, and the types of task LADIE gathered. The analysis was confined to the main success scenarios since these are the ones that practitioners are actually using.

Background

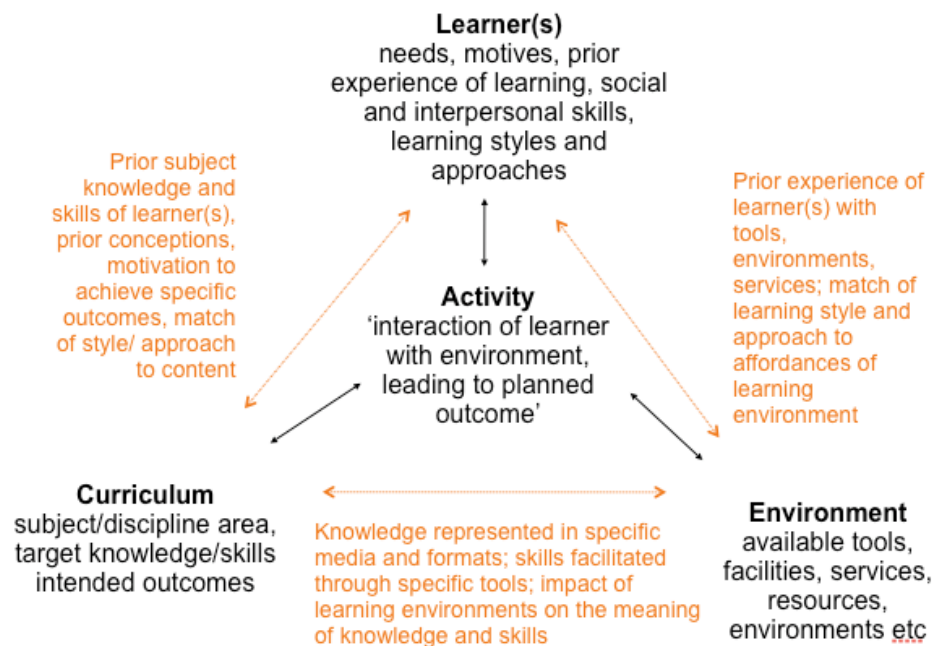
The E-Learning Framework (ELF) was an initiative by the U.K.'s Joint Information Systems Committee (JISC), the Australia's Department of Education, Science and Training (DEST), and the Carnegie Mellon Learning Services Architecture Lab (LSAL), and others, to build a common approach to Service Oriented Architectures for education. The E-Learning Framework aimed to make explicit the network functions of e-learning to offer greater interoperability between systems and software, and to create a common approach across the e-learning community. The ELF aimed to support pedagogic innovation, offer more flexibility and a greater return on investment. The ELF Reference Model projects mapped specific areas of the e-learning domain to the ELF, for instance assessment, course validation and learning activities, and provided guidelines on the use and implementation of the ELF in these contexts. The E-Learning Framework was later re-named the E-Framework.

The LADIE reference model aimed to support Learning Activity Authoring (the design and construction of learning activities and the discovery, specification, sequencing and packaging of content) and Learning Activity Realisation (the construction of the environment in which learning activities are to take place and execution of the learning activities themselves). The LADIE project combined practical teaching and learning experience, pedagogy/didactics through the DialogPlus project, in addition to the needs of existing technologies.

Existing work

The reference model drew upon a number of existing JISC developments, including:

- The following emerged from the pedagogical literature review as being of particular relevance to the LADiE project:
 - The JISC ePedagogy Models Study offered a review of educational frameworks and models that could be mapped onto the reference model within the context of specific learning activities and was incorporated into the initial pedagogical review. (Mayes and de Freitas 2004)
 - The JISC ePedagogy Practitioners' Study concluded that any criteria for judging the effectiveness of learning resources were too complex to be simplified into a bullet pointed set of guidelines. Instead, these criteria were presented in a matrix structure (or 'typology') that maps how the key factors of resources, tools and services that positively influence e-learning might operate within the context of working with resources, tools and services for wider change in e-learning.. (Littlejohn 2004).
 - Many of the outputs of the ePedagogy Programme under the "Design for Learning" formed an important input to this work. The diagram below, from Helen Beetham) indicates the central role of learning activities. **See figure 1**
- The follow emerged from the technical review as being of particular relevance to the LADiE project:
 - The involvement of LAMS International, Open University of Netherlands (CopperCore), RELOAD, ICODEON (Simple Sequencing and BPEL), and Bill Olivier as associated partners was invaluable to the project.
 - The work of the VALKENBURG group in forming the LADiE architecture.
- The JISC Digital Libraries in the Classroom, 'DialogPlus Project' has developed an online toolkit that guides a tutor, step-by-step, through the process of planning learning activities (<http://www.nettle.soton.ac.uk/toolkit/>). Underpinning the toolkit is the DialogPlus taxonomy, which provides a detailed outline of the components, which make up a learning activity. This provided the basis for the workshop scaffolding/support materials, and was used in the later stages of the project as a method for mapping the characteristics of a learning activity to a case study and a basis for the gap analysis.



A specification for learning activities (H.Beetham, Feb '04)

Figure 1 From Learning Design A framework for modelling (e-)learning activities?, Helen Beetham & Sarah Knight. (www.jisc.ac.uk/uploaded_documents/Design%20for%20learning.ppt)

Aims and Objectives

The main objective was to develop a learning activity reference model (LARM) firmly based in practical experience of teaching and learning, which permits flexibility and creativity for teachers but not narrowly defined by available technology. Other objectives were:

- To record learning activity designs as a series of use cases, which were to be developed through a number of events in conjunction with experienced Higher and Further Education teachers from a variety of subject disciplines and institutions.
- To work towards precise specifications that could support conformance tests.
- To produce a reference model that unambiguously supported different groups.
- That the reference model should support two distinct stages:
 - **Learning Activity Authoring**, including the design and construction of learning activities and the discovery, specification, sequencing and packaging of content.
 - **Learning Activity Realisation**, including construction of the environment in which learning activities take place and the execution of the learning activities.
- To produce a plain language introduction that enabled readers to understand the purpose of the reference model and the expertise required to implement it.
- To define how Learning Activity Realisation and Learning Activity Authoring could be attained through components or services. Each data model would be described in detail using the format scope, data model, behaviour and data representation.

- To consider the design, construction and execution of learning activity in a way that could be used and shared by multiple institutions and learners at all stages of lifelong learning.

Methodology

LADIE used a ‘top-down’ and ‘bottom-up’ approach, documenting the requirements of effective learning activities. The ‘top down’ team were concerned with pedagogy and the needs of practitioners, whilst the ‘bottom up team’ were concerned with technical standards and specifications.

LADiE used a 3-layer approach for the project as a means to bridge the gap between practitioners and technical developers. At the ‘top end’ are the teachers or practitioners, whose primary concern is teaching and pedagogy, but who may or may not have technical expertise. At the ‘bottom end’ are technical developers, who are conversant in technology, but have little or no interaction with a teaching environment. In the centre are learning technologists, who are involved with designing and implementing solutions for teachers. The project aimed to develop a shared language for these groups to communicate with each other in an unambiguous language. The model works in the following way:

A central tenet of the project was that there was currently no mechanism for sharing knowledge and understanding between different stakeholders involved in designing for learning. Practitioners wish to communicate their technological teaching and learning needs. Developers need to translate these needs into technical specifications. Learning technologists provide a mediating role between the practitioners and the developers. The project aimed to provide a mechanism for gathering requirements from practitioners, translating these into ‘use cases’ which could then be used by the learning technologists as a means of talking to the developers. The inter-relationship between the different components of learning activities would be represented as a reference model. Therefore the use case could then be used by the learning technologists, in conjunction with the reference model, to convey the practitioner needs to the technical developers.

3 layer approach

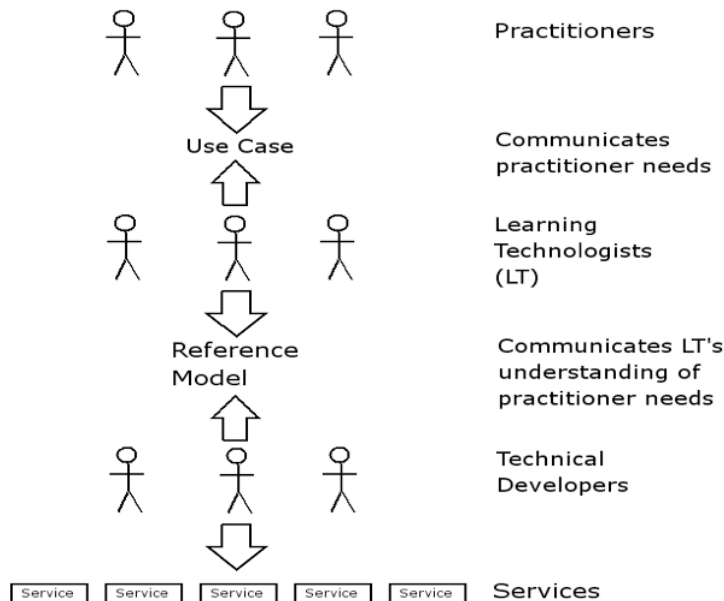


Figure 2 Bridging the gap between practitioners and technical developers

The project philosophy was to create a reference model rooted in practice, that was informed by effective approaches to teaching and learning, and that was expressed in a well defined and understood vocabulary. It was also important for the reference model to be independent of proprietary software.

Firstly, the pedagogical and technical teams explored existing e-learning pedagogies to inform the next stages of the project. The literature review for the 'top down'/pedagogical team can be found at www.elframework.org/refmodels/ladie. The 'bottom up' technical team produced 3 internal reports, in conjunction with a technical associates meeting, to define existing technology and applications and areas of overlap between these systems.

The top-down team gathered user requirements from practitioners through a series of workshops with teachers and learning technologists. Initial feedback from and evaluation of the first workshop indicated that practitioners found it difficult to create use cases initially in the required format and therefore subsequent workshops were adapted to focus on gathering the actual learning activities from the practitioners rather than the use cases. (See Appendix A for a full description.) This is discussed in more detail in the 'implementation' section below. A series of templates were created that mapped to the DialogPlus taxonomy of the components of a learning activity along with supporting crib sheets. The templates were devised to ask a series of practitioner-focused questions to gather information on the learning activities in enough detail that they could then be translated by the team into a more technical use case. The material was also designed to promote the dialogue needed between practitioners and technical specialists in creating learning activities and on going evaluation during the workshops by the team aimed to capture some of this discussion and the issues, which arose in order to feed into the subsequent design of the reference model. The supporting crib sheets aimed to:

- Create a shared language of teaching approaches
- Encourage the communication of ideas
- Acknowledge specific learner needs, e.g. accessibility.

A series of learning activities were produced from the workshops, which were then translated into more technical use cases in conjunction with the 'bottom up'/technical team. Four workshops were run in total with refinements made to each workshop via the evaluation forms and 16 (usable) learning activities were produced.

The bottom-up team worked with the top down team in translating the learning activities gathered in the workshops into 'use cases'. 7-8 use cases were chosen to form the basis of the reference model, with permission from JISC. These were subsequently mapped onto existing interoperability standards and specifications by the technical team to provide a basis for the reference model. The LADIE architecture was defined from the use cases developed, which explored further the technical domain of the reference model. A draft 'reference model' was developed which was discussed in detail at a technical associates meeting in February 2006. The focus of the reference model was discussed and recommendations made. From these discussions, the implementation and services guides were produced, and the architecture refined. A pedagogy guide was developed to map against both the technical and implementation guides and also against the requirements gathering process.

A gap analysis was undertaken by the top down team, which mapped the LADIE use cases against the DialogPlus taxonomy. This mapping was based on the main success scenarios of use cases 1-9 and 11-16. The gap analysis identified the pedagogic focus of LADIE use cases, and the types of task LADIE gathered. The analysis was confined to the main success scenarios since these are the ones that practitioners are actually using. The gap analysis can be found on the project website at <http://www.elframework.org/refmodels/ladie>. (Issues relating to the gap analysis can be found in Appendix A.)

Implementation

Pedagogical and technical reviews were undertaken to identify and build on the existing body of work. The top down team examined existing e-learning tools and pedagogical theory to explore the idea of mediating forms of representation. The resulting literature review can be found at <http://www.elframework.org/refmodels/ladie>. The project team also consulted Helen Beetham on her work on gathering learning activities in the e-Pedagogy strand. The initial reviews and the evaluation from the workshops confirmed that codifying existing educational practice through the gathering of learning activities is a complex process; both because of the difficulty of codifying 'tacit' knowledge and the problem of eliciting experience from practitioners – particularly trying to elicit innovative and forward thinking examples of practice which makes new ways of using the technologies. The bottom

up team produced 3 internal reports, in conjunction with a technical associates meeting, to define existing technology and applications and areas of overlap between these systems. These reports consisted of an existing technologies report, a first draft specification of the reference model and a draft reference model.

The LADIE project designed and ran a series of workshops developed to gather use cases for the reference model. The initial workshop was based on practitioners developing use cases themselves using a use case template like the one illustrated in figure 2, and to guide them through the writing process, providing scaffolding via the templates and the expertise on hand.

Use Case Summary	
Teacher runs an online a discussion conference with students	
Primary Actor (and goal)	
Teacher	To administer the discussion conference successfully
Other Actors (and goals)	
Students	To engage in dialogue and develop concepts to pass the course
Moderator	To keep conference running smoothly, both socially and organisationally
Preconditions	
1	System with conferencing facilities
Main Success Scenario	
1	Teacher sets up small group conferences in system and defines student groups
2	System attaches students to teacher-defined discussion groups
3	Students discuss asynchronously in small group conferences
4	Teacher monitors small group conferences
5	System saves records of conferences
6	Students access saved conferences for future work
Extensions	
1a	Teacher is overworked and will not have time to monitor conferences
1a1	Teacher appoints student moderators for conferences
3a	Some messages are inappropriate
3a1	Moderators edit or remove messages
4a	Student participation is low
4a1	Teacher changes conference structure so new messages are more easily visible

	(e.g. by doing away with subconferences)	
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Figure 3 Initial use case template

This method proved to be unsuitable for a number of reasons:

- The approach was too time consuming to be effective as a method, both in terms of the time and support needed for practitioners and also the amount of communication needed between different groups to facilitate the use of this single form of representation.
- Practitioner training in developing this form of use case would be needed.
- Practitioners had difficulty decontextualising the learning activity and concentrating on the structure of the process, and in separating the roles and actions of the practitioner in the process from the aims of the learner.
- The use cases were not suitable as a basis for the reference model without further work by the team. The project team consulted with Bill Olivier about these initial use cases for feedback.

As gathering information on the context of the learning activity and adopting as much as possible a learner-centred approach were necessary, it was decided to create templates that were designed to gather activities as case studies. These templates asked for explicit detail on the teaching context and learner needs, and then a step-by-step description of teacher and students actions during the activity. This approach gained better results, and the templates were further refined in light of workshop evaluation, to ensure that the materials and templates were more closely aligned and clearer in their expression.

The team then took these case studies and derived use cases from them, consulting back to the case study authors to check interpretations. Three major issues were identified during the learning activity gathering process:

1. Issues concerning granularity and aggregation. How long should a learning activity be? A fuller discussion of this can be found in the top down issues paper in Appendix A.
2. Breadth versus depth. Practitioners appeared to have an unrealistic understanding of the sophistication of existing interoperability standards. This led the team to ensuring that the use cases would gather as wide as possible a selection of service components. What the technically focused team members needed was to develop a core reference model based on an in-depth analysis of the requirements of a limited number of core functions such as discussions and quizzes. The purpose of the case studies, from their viewpoint, was to identify which these core functions were.
3. Difficulties in gathering examples of future or innovative practice. The learning activities gathered through the workshops focussed on modelling existing practice, rather than future visioning and potentially innovative uses of tools and technologies. This raises the question of how one can predict for the future. A truly useful reference model would have some element of future proofing and visioning contained within it – evidencing the potential as well as existing uses of tools and new and innovative future practice.

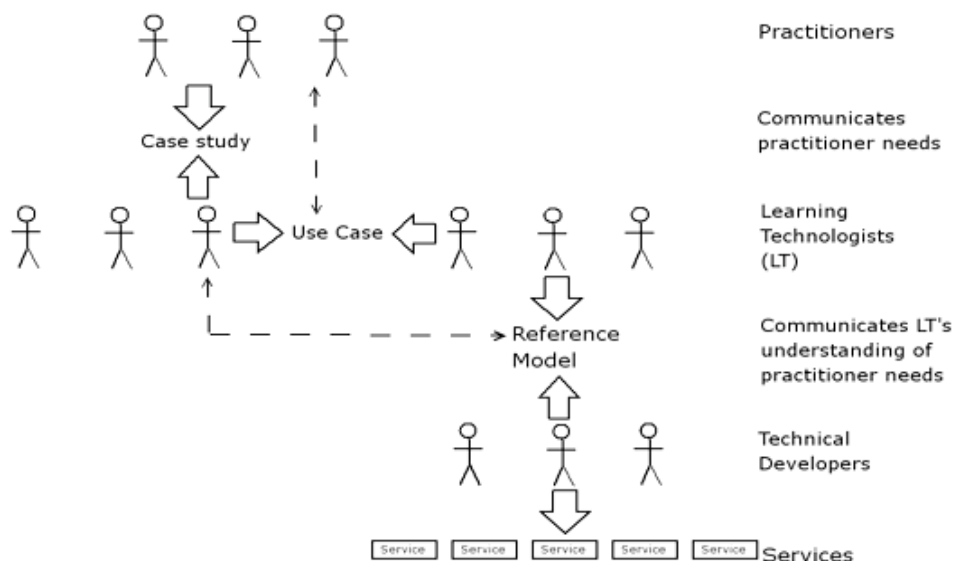


Figure 4 Communication structure and templates used in the LADIE project

The main communication around developing the use cases was between the learning technologists in the LADIE team. This demonstrated clearly that there were two different, though overlapping, communities of learning technologists: practitioner-focused and technically-focused, as reflected in the project team, and that a substantial amount of communication between the two was necessary to develop a representation that was meaningful and fit for purpose for both. This supports Sharpe et. al.'s suggestion that representations of practice should be "enhanced by their participation in collaborative activities" (Sharpe et. al, 2004).

The bottom up team were involved in the work of the top down team, which proved to be more complex than initially realised. Although this is a positive aspect of the project, ensuring communication between teams, it affected the time available for the technical team to be able to work on technical aspect of the LARM. It was agreed with JISC that the reference model could be developed from a core 7-8 use cases rather than the originally planned 20. It was also agreed that an implementation would not be undertaken during the lifetime of the project, as project time and resources would not allow for this. LADiE produced 16 (usable) use cases, and these are available via the project website. A subset of these was chosen based on their relevance in terms of demonstrating the reference models and on their level of detail. The remaining use cases were felt to be too ambiguous for the purpose, and it was felt that it would be difficult to extract requirements accurately. The Use Cases not used in the LARM have subsequently been developed further to enable them to be suitable for use in future projects.

The technical team initially examined one of the initial use cases and broke it down into a set of requirements and then produced the associated specifications for web services. The learning activity in the use case was then expressed in IMS Learning Design using the RELOAD LD editor, the aim of which was to form the basis for the next set of deliverables. This process helped clarify the focus of the use cases, and provided a discussion point for with technical partners and contacts. An example of a LADiE use case/case study in IMS LD can be found in the Implementation Guide.

The technical team developed the LADiE architecture throughout the project, working with the assumption that it would be further the work of Bill Olivier (see http://www.jisc.ac.uk/uploaded_documents/Learning_Design_State_of_Play.pdf.) However, the architecture was simplified after analysis of actual examples, and likely vendor development. It was decided that whilst all the functionality of original Bill Olivier diagram was relevant, it may be unlikely that the architecture would be divided into so many services. For example, for a tool covering the Learning Activity Runtime Engine functionality to include the functionality associated with the Service Manager and Content Rendering Manager.

A draft reference model v 0.2 was produced by Intrallect for review by technical associates in early February 2006. At this stage the pedagogical aspects were not included, but initial drafts of the implementation and services guides were made available. This was to ensure that the version of the

pedagogical guide was informed by and matched that of the other two layers. The meeting proved invaluable in providing guidance on the focus for the LARM, and a number of issues were raised at the meeting:

- Two Types of Learning Activity Editor may be needed to accommodate the needs of different e-learning communities, e.g. technical orientated versus pedagogically orientated.
- Orchestration technologies. It was suggested that the LARM focus on the orchestration of services as opposed to supporting services such as ePortfolio, Assessment etc.
- Function calls vs. document exchange. Another major topic for discussion at the LADiE technical meeting in February 2006 was whether the services should be used for document exchange or function calls.
- How much should be controlled by Learning Activity and how much by the player? To what extent the central application (Learning Activity Runtime Engine) needs to know what the other services are doing.
- Flexibility required by practitioners. This identified the blurring of distinction between runtime and authoring as it might be necessary to edit the learning activity at runtime.

For a fuller discussion of these issues see the bottom down issues document.

The pedagogical guide for the LARM was produced by the top down team, with guidance from Intrallect. The pedagogy guide also addresses planning/designing learning activities, which is a stage prior to the 3 stages described in the guide (Authoring, Set-Up then Delivery). This additional phase arises as authoring tools exist that facilitate planning and designing for learning (e.g. LAMS.)

The implementation and services guides were produced the bottom up (technical) team, The implementation guide is intended to act as a bridge between the Pedagogy Guide and the Specifications Guide and includes a description of the service-oriented architecture and the technologies on which the reference model is based The Services or Specifications Guide is designed to be used by developers and vendors as a basis for developing applications and interfaces. The guide is essentially a reference manual for those producing software systems. It will provide all the required details of standards, schemas, protocols, syntax, parameters and extensions.

The gap analysis was changed to from one relating to an implementation to focus on the use cases gathered in the workshops. It mapped LADIE use cases against the DialogPlus taxonomy, identified the pedagogic focus of LADIE use cases and the types of task LADIE gathered. The gap analysis then went on to provide an analysis of tasks versus tools, tasks versus techniques, tasks versus roles and interactions.

Outputs and Results

Dissemination Workshops and Outputs

Timing	Dissemination Activity	Audience	Purpose	Key Message
Apr 05	JISC Programme Meeting	JISC projects	Raise awareness of project.	Identify the needs of the community
June 05	Ed-Media	International community	Raise awareness of project	Paper given on DialogPlus with reference to LADIE reference model
June 05	UNFOLD Portugal	Learning Technologists	To raise awareness of teacher's viewpoint in Learning Design Project survey of LD tools and technologies Papers given to explore relationship between DialogPlus and LADiE RM.	Learning Design through DialogPlus taxonomy. Dissemination of use case activities Current tools and technologies in LD
7-8 July 05	JISC Programme Meeting	JISC projects	Dissemination and networking with other JISC projects.	Meeting needs of JISC and JISC related projects
July 05	ELF Dev Forum	ELF Developers	Discuss ELF and RM technical issues. LADiE team present for discussion and general dissemination.	Update on project progress
July 05	LADIE Learning Activity Workshop	Learning technologist/teachers – 13 participants	To develop LADIE use cases for the reference model.	Produced 11 use cases. Workshop materials included crib sheets, taxonomy, and templates.
Aug 05	3 technical reviews	Project team	Existing technologies Specification of reference model Draft reference model v1	To disseminate and debate amongst technical partners.

Aug 05	Literature review	Learning technologist/teachers	To explore existing practice in relation to both pedagogy in general and emerging trends.	Mediating forms of representation enable teachers to exploit technology in creating pedagogically sound activities.
Sept 05	Reference Models Meeting	JISC	LADiE team present for day conference/meeting on reference models	Liaise with other RM projects, disseminate
Sept 05	ALT-C 2005	Learning Technologists	LADiE pre-conference workshop on gathering learning activities	Raise awareness and gain feedback
Oct 05	UNFOLD Glasgow	Learning Technologists	Paper given on LADiE and technical issues	Raise awareness and gain feedback
11 Nov	LADiE Learning Activity Workshop	Learning Technologists and Teachers 9 participants	To gather case studies of existing practice. These were then translated into use cases.	Produced 11 case studies. Workshop materials included learning activity templates, learning activity taxonomy, learning styles and pedagogy crib sheets, glossary of terms.
15-16 Nov 05	JISC/CETIS conference	Technical developers	Paper given and workshop participation by team	Work so far on project
30 Nov 05	Online Educa Berlin	Technical	Pre-conference workshop organized by LADiE project	Papers on all 5 reference model projects and UNFOLD and SLED
14 Jan 06	LADiE Learning Activity Workshop	Learning Technologists and Teachers – 6 participants	To gather case studies of existing practice. These were then translated into use cases.	Produced 3 case studies. Workshop materials included learning activity templates, learning activity taxonomy, learning styles and pedagogy crib sheets, glossary of terms.
February 06	Draft reference model v2s	Technical	For discussion at LADiE technical partners meeting.	How suitable is this for technical development at your institution?

March 2006	CETIS SIG meeting	LT associated with Educational Content standards	Raise awareness and gain feedback on reference model overall Research paper	Work so far on project (technical)
March 2006	Reference Models Meeting	JISC RM projects	Paper on LADiE reference model work.	Dissemination and discussion of what LADiE RM entails.
April 2006	Deliverables: Pedagogy guide for reference model Implementation guide for reference model Services guide for reference model Use cases – 16 plus 2 generic Literature review Workshop materials Gap analysis			www.elframework.org/refmodels/ladie Sixteen learning activities, gathered mainly from three one-day workshops..
April 2006	Networked learning	Research community	Research paper	Work of pedagogy team on reference model – bridging the gaps between teachers, learning technologists and systems developers
September 2006	ALT-C Workshop	Learning technologists and teachers	ALT-C workshop Test templates and disseminate project work	Refine model Begin to embed model in an ongoing Community of Practice

Literature review

The purpose of the review was to:

- To provide a background to the development of the learning activity use cases
- To introduce the concepts of learning design, learning activities and use cases
- To provide clear definitions of the terminology
- To communicate the role of use cases developing reusable learning activities

In the review, the project has attempted to give a background to the development of learning activity use cases, showing their role within the context of the current state of research into e-learning pedagogy. Two issues were immediately apparent. First, that the relationship between theories, models, and the development of learning activities was a very complex one. Second, that in discussing this relationship there were considerable inconsistencies in terminology and usage in the literature, which might be problematic for learning activity design. This was of particular importance in the development of use cases, which should be underpinned by a standardised vocabulary. The report has attempted to bring some coherence by distinguishing four levels of abstraction of theory or mode, and to explore how these were related to common usages of the terms. All of these levels, perspective, theoretical position, theoretical approach, and mediating representation, might well

impinge directly on the design of activities. Additionally, the report highlighted the constraints of use cases in mapping interactions and support services.

Use cases

Developing use cases proved to more complex than initially realised. In the process of gathering use cases, the project team needed to consider the following:

1. Levels and types of communication needed
2. Problems with decontextualising the learning activity and concentrating on the structure of the process;
3. Difficulty in separating the roles and actions of the practitioner in the process from the aims of the learner.
4. Issues relating to breadth versus depth and granularity versus aggregation

Further information can be found in Appendix A.

Learning activity templates and materials

The learning activity templates and materials are available via the project website (<http://www.eframework.org/refmodels/ladie>). The templates and scaffolding materials are intended to form the basis of further work gathering use cases in workshops. Further information can be found in the Top Down Issues document in the Appendix A.

Pedagogy Guide

This guide was aimed at tutors and practitioners, and was designed for use by teaching practitioners who need to design and implement learning activities. The guide covered Planning, Authoring, Set-up and Delivery of a Learning Activity. The planning stage addressed is, in fact, an additional stage prior to Authoring, and aimed to offer guidance on how to create a learning activity. The guide also covered the effective use of tools and resources in implementing activities, and a language and structure to enable discussion of the development and implementation of learning activities by teaching practitioners and learning technologists.

The guide had been designed as a “best practice guide” to highlight recommended modes of design and implementation. The guide presented the information in two different structures: first according to the structure of the LARM; and second by working through an example of a learning activity, guided by a template.

Implementation Guide

The Implementation guide was designed for use by educational technologists who need to implement frameworks to support learning activities. The guide was intended to act as a bridge between the Pedagogy Guide and the Specifications Guide and included a description of the service-oriented architecture and the technologies on which the reference model was based.

The guide formed a “best practice guide” to highlight recommended modes of implementation. For example, a learning technologist might use the guide to implement a technical solution to a learning activity. The guide would be used to identify the services available, to provide guidance on the orchestration of these services, and the technologies could be implemented. .

Services Guide

The Services or Specifications Guide was designed to be used by developers and vendors as a basis for developing applications and interfaces. The guide essentially formed a reference manual for those producing software systems. It aimed to provide all the required details of standards, schemas, protocols, syntax, parameters and extensions.

Each service in the LARM was described using the following hierarchy:

- Definition of functional scope

- Abstract model of data behaviour
- Data representation specification (e.g. XML)

Gap analysis

The gap analysis showed that the LADiE sample of learning activities was heavily discussion- focused and almost entirely computer or face-to-face based learning – covering only a fraction of the potential sub-components of a learning activity identified in the DialogPlus taxonomy. An important question was whether this predominance of computer-mediated and discussion focused teaching reflects current practice among innovative practitioners, or whether it reflects either the data collection methods used in LADiE or the bias imposed by the requirement on LADiE to write a reference model for the e-Framework, which in turn might reflect the current state of interoperability standards.

Further information can be found in the Appendix A.

Outcomes and conclusions

Our main objective was to develop a learning activity reference model firmly based in practical experience of teaching and learning, which permitted flexibility and creativity for teachers and which would not be narrowly defined by available technology. However, there were a number of other project objectives:

- **To record learning activity designs as a series of use cases, which were to be developed through a number of events in conjunction with experienced Higher and Further Education teachers from a variety of subject disciplines and institutions.**

There was a change to using a process to gather case studies in the workshops, and then translation of these by the project into use cases. Workshops and materials were refined and through an iterative process, based on evaluation of both workshops and materials. The methodology proved successful though the gap analysis shows emphasis on particular tasks. The project has identified a useful means of capturing current practice, and communicating those ideas to more technically focussed communities in e-learning, whilst also retaining emphasis on the use of pedagogy and the learner. (Further details in Appendix A.)

- **To work towards precise specifications that can be supported by conformance tests.**

Whilst the project has worked towards a reference model that can support conformance testing, there is much work to be done on the Learning Activity domain before this is possible.

- **To produce a reference model that unambiguously supported different groups, independently developing to the same model in the expectation that their services will be interoperable.**

Details of this can be found in the individual Pedagogy, Implementation and Services guides, these clearly detail the information needed to support each group identified by the LADiE methodology.

- **The reference model for this domain should support two distinct stages:**
 - Learning Activity Authoring, including the design and construction of learning activities and the discovery, specification, sequencing and packaging of content.
 - Learning Activity Realisation, including construction of the environment in which learning activities are to take place and execution of the learning activities themselves.

The authoring and planning stages formed an important aspect of the Pedagogy Guide as these were expected to directly involve practitioners or learning technologists working in conjunction with practitioners. The LADiE workshops and support materials also formed a useful tool for gathering practitioner requirements, particularly in conjunction with a learning technologist. The case studies developed enable the definition and discussion of requirements between different stakeholders in learning activity design and delivery.

The latter stages of execution and delivery were the domain of the Implementation and Services guides, these guides considered the LARM architecture and subsequently focussed on the sequencing and orchestration of activities after the February 2006 meeting.

- **To produce a plain language introduction that would enable readers to understand the purpose of the reference model, and the expertise required to use it and to implement it.**

The project produced 3 guides for 3 different communities in accessible language. Each guide includes information relevant to that community to elucidate the LARM, but not necessarily applicable to other communities. This highlighted the need for information specific to each community in addition to that which overlaps with other communities. Additionally, the LARM guides took into consideration the change of focus required by each community.

In the future, further work would need to be undertaken on the both the implementation guide and services guide.

- **To define how Learning Activity Realisation and Learning Activity Authoring could be attained through components or services. Each data model would be described in detail using the format scope, data model, behaviour and data representation.**

Details of this can be found in the Services Guide on at <http://www.elframework.org/refmodels/ladie>.

- **To consider the design, construction and execution of learning activity in a way that can be used and shared by multiple institutions and learners at all stages of lifelong learning.**

This was achieved through the workshops that gathered the case studies as practitioners attended from all sectors of the UK education industry as detailed earlier in the report.

Conclusions and further work

Conclusions from the pedagogy team

The first project output, the literature review, identified two main issues. First, that the relationship between theories, models, and the development of learning activities was a very complex one. Second, that in discussing this relationship there were considerable inconsistencies in terminology and usage in the literature, which can only cause problems for learning activity design. This is of particular importance for the development of use cases whose usefulness should be underpinned by a standardised vocabulary. The report aimed at forming a coherent approach to these discussions by distinguishing four levels of abstraction of theory or mode, and exploring how these relate to common usages of the terms. All of these levels, perspective, theoretical position, theoretical approach, and mediating representation, may well impinge more or less directly on the design of activities. The report, additionally, highlighted the constraints of use cases in mapping interactions and support services, particularly for learning activities that include the generation and reuse of second order learning objects.

Project team experience has shown that the process of using representations of pedagogical theory, (mediating representations such as DialogPlus) to mediate communication between a variety of communities the process is considerably more complex than is apparent from previous studies based on single or closely related communities. Additionally, gaps between some communities, even those united around a common endeavour such as teachers communicating their needs to technical developers, appear to be too wide to be bridged by a single type of representation. In the LADIE project it took at least three communication steps, each centred around a different type of mediating representation, and involving two intermediate communities of participants, to migrate a concept of system requirements from practitioner to technical developer. In each of these steps, the communities overlapped: practitioner – practitioner-focused learning technologist; practitioner-focused – technically-focused learning technologists; technically-focused learning technologists – technical developers. The overlap allowed active reciprocal communication between originators and end users around the representation – a necessity suggested by Sharpe et. al. (2004) and Conole's (2006) work on effective mediation and assumed in our definition of a mediating representation.

The overlapping communities were sufficiently close in their practices, language and modes of thinking to be able to communicate around the representation within a reasonable time frame. The time constraints noted by Beetham (2001, 2002) and Conole (2006) were most apparent at the first

stage, whilst documenting practitioners' learning activities within workshops. They became less significant at the second and third stages where participants (project team members) were communicating concepts. In developing the use cases, when relatively free from time constraints, LADiE developed representations that seemed both information rich and highly adoptable by learning technologists. However, the same representations proved neither adoptable nor informative to the practitioner community, which underlines the project focus that representations need to be tailored to the practice of their participants.

Conclusions from the technical team

One of the results of the LADiE Technical Meeting (Edinburgh, Feb 2-3) was the idea that the focus of the LARM should be less on the supporting services (e-Portfolio, Assessment, Discussion etc.) and more on how these services might be sequenced/orchestrated. It was felt that there were already other projects, which were looking at services like e-Portfolio and Assessment. For the most part LADiE has taken an IMS LD-centric approach to the problem space, despite its obvious shortcomings with regards to service orchestration.

Investigating different service orchestrating technologies

A suggestion for further work is for other technologies to be used to model one or two of the use cases developed in LADiE. This would help identify functional gaps in the various technologies.

In addition to IMS Learning Design, technologies worth investigating would be BPEL, LAMS, a BPEL IMS LD hybrid (building on the work of Scott Wilson), simple sequencing and Moodle

Technical implementation of the reference model

A technical implementation should be undertaken to better inform the reference model itself and to review the guides.

Better implementation guide

Due to lack of time/experience with the services, the current implementation guide is somewhat limited. This implementation of a practical use case demonstrates some aspects of sequencing and how information is handled by a Learning Activity Player. It could be further developed by considering practical external services and how they could communicate with a *Learning Activity Player*. In particular, considering how Learning Activity Players such as the Reload Learning Design Player and LAMS could be combined with external web services such as *Student Information Systems*, *Learning Object Repositories*, *MCQ Tools*, *Email*, *services* and *File Storage Systems*

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Appendixes

Appendix A – Top Down issues

Appendix B – Bottom Up issues

Appendix C- LARM architecture

Appendix A - LADIE Top Down Issues

Isobel Falconer, University of Dundee

Overview of gathering/generating Use Cases¹

The project documented sixteen learning activities, gathered mainly from three one-day workshops. The twenty-eight workshop participants have been a roughly equal mix of practitioners from HE and FE, and educational developers. They were known to be e-learning enthusiasts and were invited for this reason. The aim has been to document activities covering a wide range of possible teaching approaches and subject disciplines. Interviews with individual practitioners are being used to fill in disciplinary gaps in workshop participation.

Our initial intention was to get the practitioners themselves to document their activities in the form of use cases, by providing them with templates and guiding them through the writing process. The methodology envisaged is shown in Figure 1.

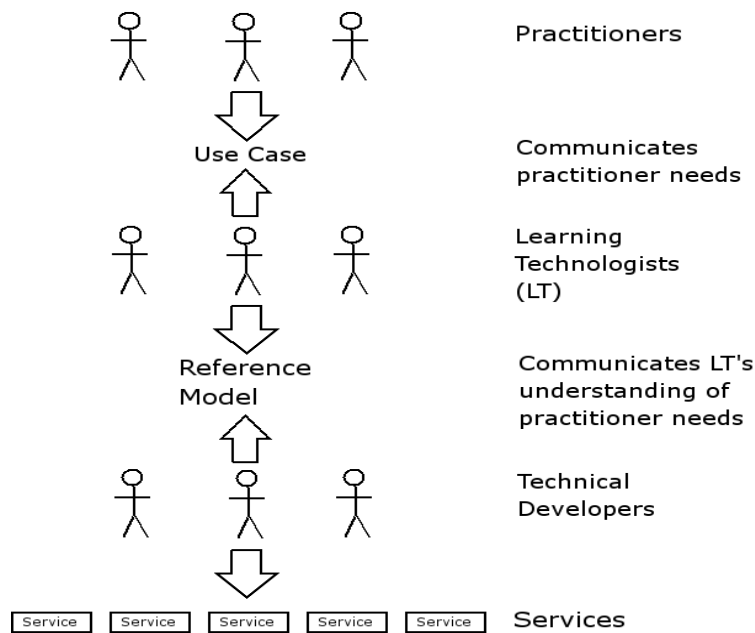


Figure 1. The communication structure and mediating representations implied by the proposed LADIE methodology

We tried this in our first workshop, but it proved extremely difficult to implement in the time available. Even with the scaffolding provided by the templates, and experts on hand to mediate the process, considerably more experience of writing use cases would be necessary before this community could utilise this type of representation of their practice effectively. The main two difficulties, even for this relatively expert group of participants, were in:

- decontextualising the learning activity and concentrating on the structure of the process;
- separating the roles and actions of the practitioner in the process from the aims of the learner.

In other words, it seemed that the customary practices of this community, which are generally heavily contextualized (refs) and aim to be learner-centred were too far removed from those of the learning technologists developing a reference model for the gap to be bridged by a single representation type,

¹ This section is taken from a paper presented at Networked Learning 2006: Falconer, I., A. Littlejohn, et al. (2006). Mediating between services and learning activities - the user perspective. Networked Learning, Lancaster.

a use case, without a great deal of further and peripheral communication that would bring the communities closer together. Given the time constraints highlighted by Beetham (2001), this means that the representation is unlikely to be effective in this user context.

In our subsequent workshops we abandoned this approach, and, instead, asked participants to document their activities as case studies. We provided templates that prompted them to detail the teaching context and learner needs explicitly, alongside a stepwise description of what they, and their students, did during the activity. This approach seemed to work far better from the practitioner's perspective. We then took these case studies and derived use cases from them, consulting back to the case study authors to check our interpretations.

The main communication around the developing use cases, though, was among the learning technologists in the LADIE team. This demonstrated clearly that we were two different, though overlapping, communities of learning technologists: practitioner-focused and technically-focused (the project team was deliberately put together in this way to implement the top-down, bottom-up approach), and that a substantial amount of communication between the two was necessary to develop a representation that was meaningful and fit for purpose for both. This supports Sharpe et al.'s suggestion that representations of practice should be "enhanced by their participation in collaborative activities" (Sharpe et al, 2004). Problems and misunderstandings negotiated through this process included:

- granularity and aggregation – the granularity of a learning activity was the subject of much debate at workshops but most participants settled on something that had a definable beginning, middle and end, generally in the form, provide students with some information, set a task based on the information, report on the result of the task. Such activities comprised a number of different sub-activities (eg. information gathering, discussion forum, report writing) but these tended to be similar from one activity to another. In writing the use cases it often proved more effective to disaggregate these sub-activities and re-aggregate the functionality required of similar ones together into generic use cases such as the discussion use case;
- breadth versus depth – the initial conception of the practitioner-focused team members was that the documented learning activities should cover as wide a range of service components as possible. However, negotiation over the form of the use cases demonstrated that this supposition was based on a false assumption of the sophistication of existing interoperability standards. What the technically focused team members needed was to develop a core reference model based on an in-depth analysis of the requirements of a limited number of core functions such as discussions and quizzes. The purpose of the case studies, from their viewpoint, was to identify which these core functions were.

Thus, collaborating over use case development proved a very effective means of bridging this partial gap between the two overlapping communities of learning technologists.

Thus, the eventual structure and mediating representations that will probably prove necessary in the LADIE project to provide meaningful communication between all communities of users looks something like figure 1.

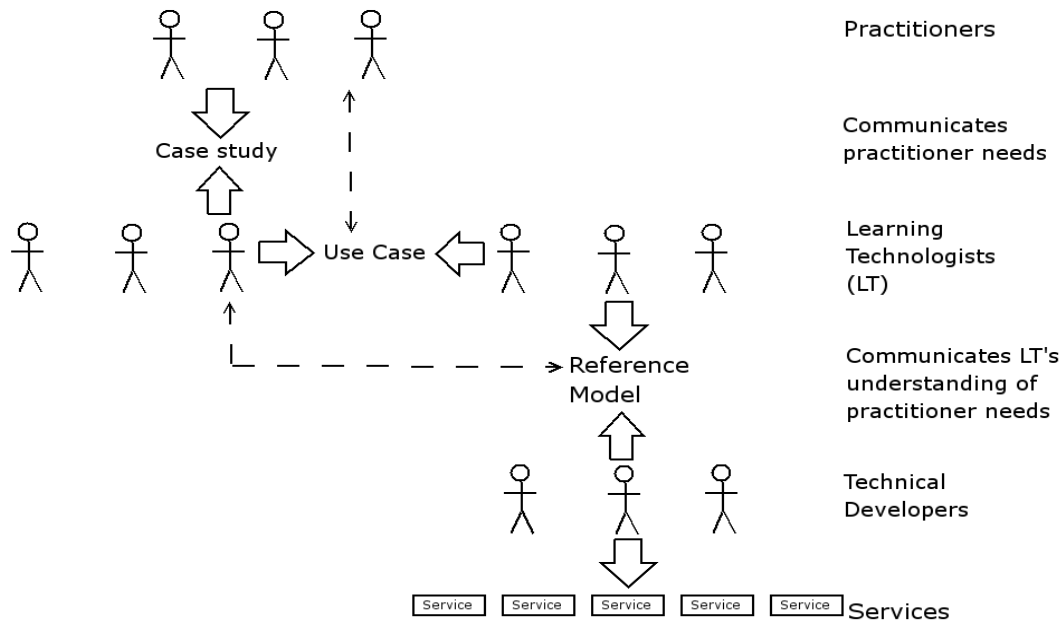


Figure 1. Communication structure and mediating representations used in the LADiE project

Gaps

The gap analysis showed that the LADiE sample of learning activities was heavily discussion focused and almost entirely computer or face-to-face based. An important question is whether this predominance of computer-mediated and discussion focused teaching reflects what is actually going on among innovative practitioners, or whether it reflects either the data collection methods used in LADiE or the bias imposed by the requirement on LADiE to write a reference model for the e-Framework, which in turn might reflect the current state of interoperability standards.

Problems with collection methods might, for example, be that in our focus on decontextualising for re-use, and our collection method via practitioner workshops, we are missing a number of the more automated activities that are available, for example on interactive websites, simulations, etc. Many of these are, or can be, reused by being taken over as 'pure' resources.

The lack of activities showing authoring/editing also reflects collection methods, and a conscious decision not to emphasise this aspect in the templates, arising from the sense from the bottom up team that this was a general area that concerns many other domains and would be dealt with elsewhere.

Workshops and development of the templates

Once the decision was made to use a case study based format for the workshops, we developed templates covering learning context and learning activity, which have been through 3 iterations. The templates were backed up by crib sheets and glossaries, intended to stimulate teachers' thinking.

In the workshops we deliberately covered context first, in the hope that this would be more successful in stimulating teachers to think beyond what their customary activities, and to some extent this was successful.

Feedback from the first workshop led to a recasting of the learning context sheet into the same format as the learning activity one, to the inclusion of questions about the difficulty of the activity and the time it took, and to a better integration with the crib sheets. In an attempt to identify technological bottlenecks we also added questions about what technologies teachers would like to have used. This was potentially successful, but as the third workshop had only 3 pairs of participants, we did not get very much useful information.

Feedback from the second workshop suggested that the materials were now cast along the right lines, but that for the pedagogy guide even closer integration, and the cutting out of overlap between the

two templates, was possible and desirable. The two templates have been combined into one for the guide.

Workshop participants at the second workshop felt that in trying to reuse learning activities there was a tension between spelling everything out for the benefit of those teaching in a completely different environment, or technical developers, and overburdening the activities with an intimidating amount of information (particularly off putting for those in closely related areas who could do with far less explanation). They also pointed out that traditional teaching relies on a lot of implicit practice and social norms, and also a lot of instantaneous self-correction. The shift to technologically mediated teaching is exposing the existence of these implicit skills.

Appendix B - LADiE Technical Issues

There were many issues encountered during the lifetime of the project, this document aims to explain the reasoning behind many of the decisions made and approaches used in the technical development of the Learning Activity Reference Model (LARM).

Set-up and Scheduling Manager

Given the feedback from various meetings, much of the functionality of the Set-Up and Scheduling Manager during the Set-Up Stage is also needed at the Runtime stage so it is unlikely that a vendor would produce a separate Set-Up and Scheduling Manager and Learning Activity Runtime Engine (LARE); it would all be the one application. Bringing these two central components together simplifies one of LADiE's potential problems: The format of the information being passed to the LARE which would be a combination of LD-type information, User Information and Service Information. This can now be handled internally by the combined Set-Up and Scheduling Manager and LARE.

If there is evidence that this functionality does start breaking up into different components then the LARM can be adapted to allow this.

The authoring was kept separate from the delivery of the Learning Activity although many tools are expected to have both functionalities. Those tools, while not necessarily storing anything in a standard form (e.g. IMS Learning Design), will probably be able to export and import standard files. It is not certain that the authoring tool would interoperate with the delivery tool directly through services. It is likely that the IMS Content Package (IMS CP) would be saved from the Authoring tool (probably into some repository service) and the Delivery tool (LARE + Set-Up) would then import the IMS CP (again, probably through some repository service). It is unlikely that an authoring service would submit the Learning Activity directly to the Delivery tool unless they were both part of the same tool in which case the information can be passed as they wish and doesn't need to be standards-compliant. LAMS is a good example of this.

Function Calls vs. Document Exchange

A big topic for discussion at the LADiE technical meeting in February 2006 was whether the services should be use document exchange or function calls.

With document exchange, a schema valid xml file is passed to a web service and another schema-valid xml file would be passed back. This keeps the function calls very simple while the xml documents contain the rich, detailed information. The WSI profile of the web services specification recommends document style web services. Extra benefits for free: Heavy lifting to accept and send complex documents but is then extremely easy to write client (flash, AJAX) to process this stuff. An example of all the function calls you need when dealing with document exchange is: Initialize, terminate, get, set and commit.

There are times when document exchange is too heavy-handed, where a normal function call would do; for example, if just one small piece of information that does not require structure.

Another point against using schemas is the practical work required. For example, if two vendors choose to make services communicate they may have specific types of interactions, which may not be covered by a document exchange system. The point is that it is difficult to define a universal document schema which covers all the required interactions since different services will function in different ways.

In the LARM the document exchange has been used wherever possible.

Configuring/Changing the Learning Activity at Runtime

The project team have had clear feedback that the configuration and, in some cases, editing of the Learning Activity should be able to happen at Runtime. This seems not to be the case with current tools. There are clearly some issues with trying to do this. If it is necessary to add a new interaction half way through a Learning Activity, but some of the students have already passed the point where it would be inserted, should that be allowed to do that? If so, what should the system's behaviour be? Alert the more advanced students to the new thing they have missed? Move them back to the new interaction? This is just one example of some logic that must be considered when updating Learning Activities during delivery.

Other examples of configuration might be changing group memberships, creating new groups if group membership is too big for existing groups and changing the role of some of the users.

Service Definitions in Learning Activity

How much detail and configurability should there be about the service definitions? For example, is it possible to just say that the Discussion forum service needs to exist or might you want to also define some specific functionality (e.g. user can attach file to post) required from that application for the learning activity to meet its pedagogical purpose? For the purpose of this version of the LARM, the project team assume that if the discussion service is part of the architecture then that means that it meets all the requirements of the service, as defined in the LARM. Further development of the LARM may want to look at the granularity of service definitions as described in the Learning Activity.

Additionally, should the Learning Activity determine whether results/material are archived (using a service outside of the Learning Activity Player) or should this be configured in the Learning Activity Player itself? LADiE recommend the latter as it feels like a decision which would be made at an institutional level. To define it in the Learning Activity makes that Learning Activity less usable. To clarify, this argument only applies when the materials are being archived so that they can be accessed long after the Learning Activity has finished, not when the Learning Activity Player is storing materials for use later in the activity.

Learning Activity Editors

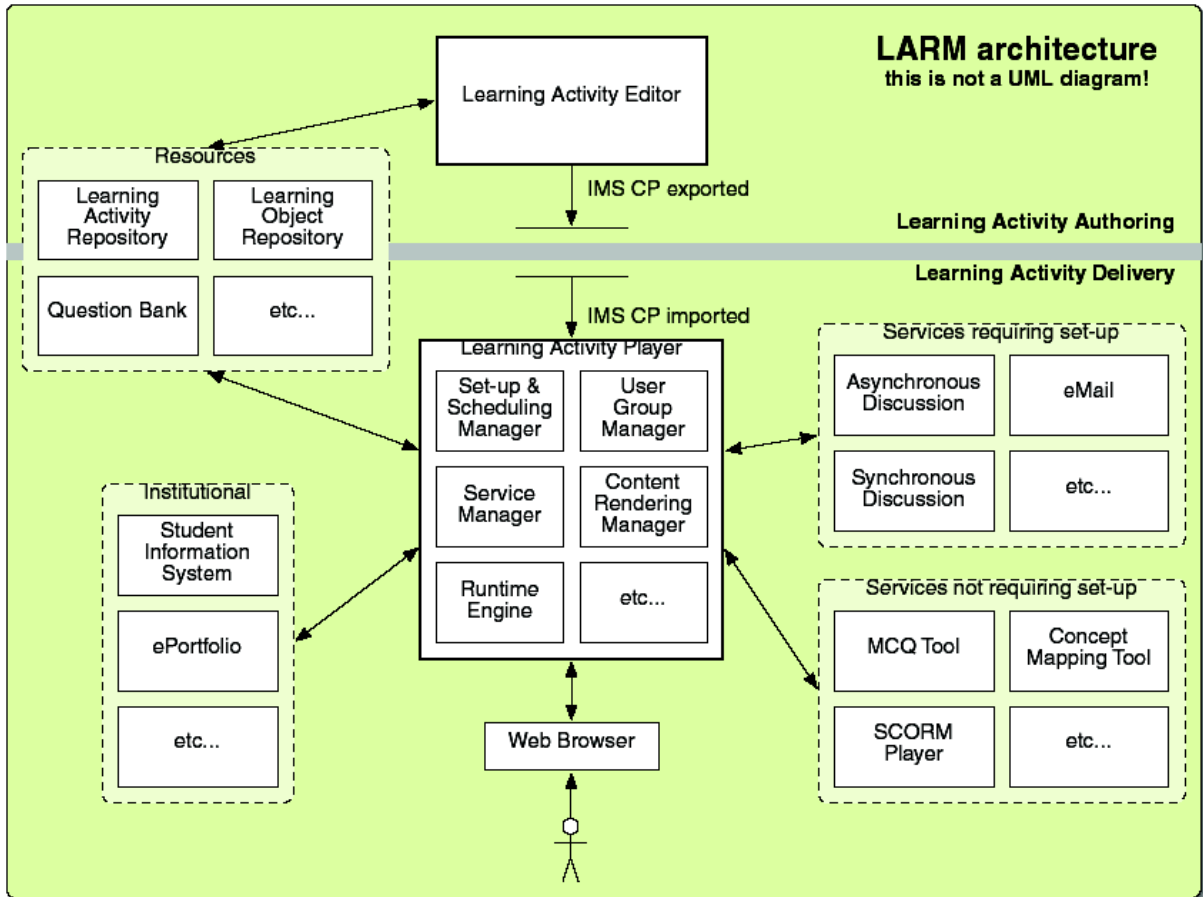
Through the project team experience attending various meetings, it is recognised that there may be a need for two types of Learning Activity Editor. A technically-oriented tool (like RELOAD) which exposes the full flexibility of the LD spec to the user and a more user-friendly tool (like LAMS) which provides a number of templates addressing common pedagogical scenarios that the user can complete without being exposed to the complexity of the spec. The more technical tool could even be used to produce templates to be used in the teacher-friendly tool.

The editor would probably include some method of previewing the Learning Activity but this functionality is not included in LARM. It would probably involve some of the "rendering services" found at the Delivery Stage.

Orchestration technologies

One of the results of the LADiE Technical Meeting (Edinburgh, Feb 2-3) was the idea that the focus of the LARM should be less on the supporting services (e-Portfolio, Assessment, Discussion etc.) and more on how these services might be sequenced/orchestrated. It was felt that there were already other projects, which were looking at services like e-Portfolio and Assessment. The Implementation and Service Guides both contain some discussion on orchestration technologies, but LADiE recommends that a major area of further work should be to investigate various candidate orchestration technologies. A useful exercise would be to try and implement one of the LADiE Use Cases using the various technologies the project has identified.

Appendix C – LARM architecture



Discussion of the architecture can be found in each of the 3 LARM guides.