The teacher as action researcher: Using technology to capture pedagogic form[1]

Diana Laurillard

London Knowledge Lab, Institute of Education

+44 20 7763 2162

d.laurillard@ioe.ac.uk

Abstract

The paper argues that we make best use of learning technologies if we begin with an understanding of educational problems, and use this analysis to target the solutions we should be demanding from technology. The focus is to address the issue from the perspective of teachers and lecturers – the 'teaching community', and to consider how they could become the experimental innovators and reflective practitioners who will use technology well. Teachers could become 'action researchers', collaborating to produce their own development of knowledge about teaching with technology. For this to be possible, they must be able to share that knowledge, and the paper proposes the use of an online learning activity management system (LAMS) as a way of capturing and sharing the pedagogic forms teachers design. An action research approach, like all research, needs a theoretical framework from which to challenge practice, and paper shows how teachers could use the Conversational Framework to design and test an optimally effective learning experience. Examples of 'generic' learning designs illustrate how such approach can help the teaching community rethink their teaching, collectively, and embrace the best of conventional and digital methods. In this way they will be more likely to harness technology to the needs of education, rather than simply search for the problems to which the latest technology is a solution.

Introduction

There are two current issues in education that have an interesting complementarity. One is the perennial concern with the achievement of better learning outcomes – higher attainment in the basic skills at primary level, more and better performance across the curriculum at secondary level, more and better support for lifelong learning in further education, and higher-skilled graduates at university level. A second, admittedly one that concerns far fewer people, is how best to use new technologies to support education. Education has problems. Technology has solutions looking for problems. The two should fit, and this conviction fuels the continuing interest in 'technology-enhanced learning'. But the solutions technology brings, in their most immediate form, are solutions to problems education does not have. The current vogue for podcasting is a good example[2]. It is an excellent solution to the problem of providing personalised mobile auditory wallpaper. However, no-one ever suggested that the reason why education is failing is that learners do not have enough access to people talking to them.

[1] Laurillard, Diana (2008) 'The teacher as action researcher: Using technology to capture pedagogic form', *Studies in Higher Education*, 33(2), 139-154. This paper is based on a keynote address to the 4th International Conference on Lifelong Learning: Partners, Pathways, Pedagogies, Central Queensland University, Rockhampton, 14-16 June 2006.

[2] A 'podcast' is a digital file, usually audio, that can be downloaded automatically to a media player, such as an iPod, so that learners can listen to, usually, lectures in their own time.

This paper sets out an argument for starting with an understanding of the educational problems and using this analysis to target the solutions we should be demanding from technology. It is a perfectly legitimate exercise to be inventive in our use of technological opportunities, but if we are always technology-led we get sub-optimal solutions. We might, for example, think up many uses for a sledge-hammer – perhaps to crack nuts? It is imaginative and effective, but sub-optimal, because if you start with the problem of how best to crack a nut you develop a quite different tool. iPods were developed by working out the optimal technological solution for people who wanted to listen to music, not for people wanting to learn. If we want to create the optimal technological solutions for the requirements of education, we need the equivalent of nutcrackers, not sledge-hammers, to crack that nut.

The focus here is to consider the educational enterprise from the point of view of teachers and lecturers. They have too little help in addressing the issue at the heart of our educational problems: 'how to identify and provide what it takes to learn'. It is a critical issue in every sector of education. The details of the solutions may differ, but there is more commonality than difference across the sectors, so we may as well take an inclusive, cross-sector approach. Terminology is one detail that differs, so this paper uses the phrase 'the teaching community' to include primary and secondary teachers, lecturers, professors, trainers, and teaching support staff. The use of the word 'community' is important because it carries the flavour of collaboration across disciplines and sectors. Innovation in education is time-consuming and difficult to develop effectively. We make progress faster if we can learn from each other, and especially if we can transfer the proven pedagogical practice through cross-disciplinary collaboration. Educational innovation would benefit from better ideas and from less of the 'reinventing the wheel' approach that is so inefficient and slow to achieve impact.

The aim, then, is to begin with a point of view about what it takes to learn, and what the teaching community need if they are to be able to address the problem of providing for effective learning. By developing an understanding of the teaching community's requirements we then build a better specification of some of the technology solutions we need. If we problematise teaching and learning, confront the need for innovation, and turn the teaching community into a profession capable of being experimental innovators and reflective practitioners, then we release a huge resource of energy and imagination for tackling the core educational problem of enabling what it takes to learn. Is it feasible? This paper claims it is.

What does it take to learn?

Theories of learning are there to guide our approach to providing what learners need, and in the context of exploring how best to support lifelong learning, we need a theoretical approach that defines what any teaching strategy should provide, conventional or technology-based. The 'Conversational Framework' for learning was developed to do exactly this (Diana Laurillard, 2002b)being

- developed from research on student learning
- a combination of the theoretical perspectives of conversation theory, constructivism and reflective practice
- an account of what it takes to learn in a conceptual domain, in a formal educational context
- designed to provide a challenging framework for getting the best from digital technologies

The Conversational Framework is a way of capturing the iterative, communicative, adaptive, reflective and goal-oriented actions with feedback that are necessary to

support the complete learning process. It shows that the learning process has to operate on two levels, discursive and experiential (see Figure 1):

> On the discursive level, teacher and student exchange theoretical ideas and concepts, discuss, ask questions, comment, critique, articulate alternatives, and students do the same with each other (activities 1, 2, 3, 12, 13, 18). This level describes learning through listening, reading, writing, discussing, communicating, debating, articulating, presenting, etc.
>
> On the experiential level, students work within the learning environment constructed by the teacher: an experimental lab, field trip, practice class, problem class, exercises, rehearsal, simulation, and students exchange their practice outputs, working on them together (activities 5, 7, 8, 9, 14, 16). This level describes learning by doing, practising, rehearsing, analyzing, testing, making, building, etc.
>
> The two levels of theory and practice are connected for teachers and students alike by the activities of adaptation and reflection. The teacher adapts the right task environment for learners, given the nature of their discussion and questions, and then reflects on their performance at the experiential level to inform their further presentation and discussion at the discursive level (activities 4, 11). This completes the process of being a reflective practitioner.
>
> The students adapt their actions in trying to achieve the task goal on the basis of their developing ideas and conceptual understanding, then reflect on that goal-action-feedback cycle to refine their understanding and in the light of that adapt and revise their action to achieve the goal. They may also adapt their actions on the basis of collaboration on practice output with other learners, or on the basis of their questions and comments (activities 6, 10, 15, 17). These activities describe the link between theory and practice that is necessary for learning through experimenting, investigating, collaborating, designing, constructing, etc.

This two-level 'conversation' between teacher and students describes how the process of learning should be supported if we are to take into account the full range of pedagogical theories developed from research on student learning (Diana Laurillard, 2002b), whether it is analysis of a poem, or using a spreadsheet, or interpreting geological formations – in every discipline, at every level, this kind of relationship between theory and practice, principle and application, concept and instantiation, is there.

An application of the framework is illustrated in Figure 1, for a collaborative program providing online communications linked to a science simulation game program, where learners can discuss specific points related to the behaviour of the game and their attempts to reach target goals. This covers all the elements of the framework except for the teacher's adaptation of the constructed environment, which is only done once when the game is provided – that is unless the student's experience of the game can be adjusted by the teacher, following reflection on their performance. In most educational games this is not possible (although it could be, potentially).

The Conversational Framework is focused on the learner as they are in the act of learning. It does not have anything to say about the context within which this event sits, such as the assessment method used in related exams, which would affect the kind of attention and energy students bring to a task. It has nothing to say about the technology access they may or may not have, or the level of skill in using computers. It is designed to help the teacher, working with or without technology, to think through whether they are doing enough to help their students learn what they are trying to teach. If the learning outcome they are aiming for is 'awareness of X' then they may be satisfied with coverage in a lecture or book, without practice or reflection. But if the learning outcome involves 'understanding', then that needs a tougher test, which is what the framework offers.

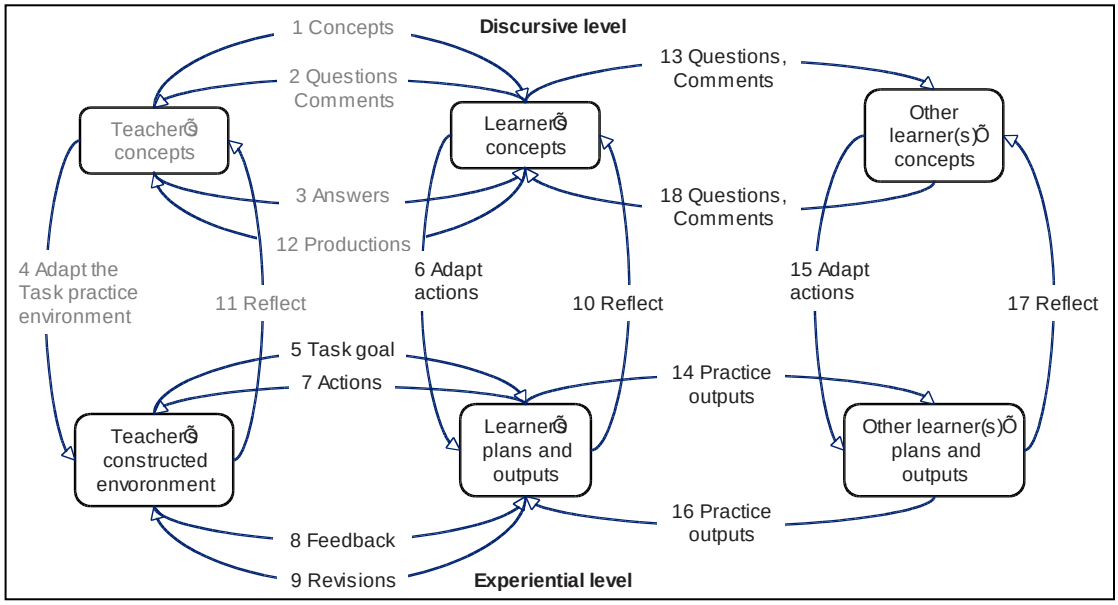

Figure 1: The Conversational Framework for supporting the formal learning process: The diagram shows the minimal interactions between the teacher and learners that would constitute a completely supported learning process, and how an online science collaboration program would not provide complete support.

Those interactions not covered by an online collaboration linked to a science simulation game are greyed out. The teacher will have presented the theory in a different session, and is not present to discuss and answer questions, though they may do this at a later debriefing session (activities 1, 2, 3, 12). Similarly, although they are adapting the students' task environment by selecting the program, they are not present to reflect on their use of it and further adapt the way it is used (activities 4, 11). The value of the Framework is therefore to demonstrate what other teaching methods must be blended with the technology-based methods to complete the support of the learning process.

It is tempting to bring technologies into learning purely because of the flexibility they offer to students whose time for study is constrained. But the quality of their learning experience depends critically on the extent to which the learning process is fully supported. Access to materials and communication is not itself sufficient, as the Conversational Framework makes clear.

The Conversational Framework (CF) provides a tough test of many of the most commonly used learning technologies. In terms of the CF, the podcast, for example, is formally equivalent to the book, the lecture, the web-page, the video, and the audio-cassette, with fewer helpful features than all of them except the last. They all provide delivery of the 'teacher's concepts' to the student, and do not cover any other part of the framework. Of course, learners may supply these other learning activities themselves – questioning and finding answers to their questions in the text, thinking through the potential application of theory or concept to a real-world task, or even setting one up, and practicing achieving their goal, reflecting on the link to their actual or imagined experience, adapting their thinking as they go. This is what good learners do when they read a book, or listen to a lecture. It defines what it takes to learn. But for the teacher who wants to support and encourage these learning activities, the simple provision of the input is not enough.

The CF also brings a tough test to the online conference. This is a valuable method for bringing together students and teachers who need flexibility of time and place to conduct their discussions. But in terms of meeting the challenge of the Conversational Framework, an online conference only supports the discursive level.

It allows the teacher to express the ideas and concepts, the students to question and express their own ideas, and to challenge each others' views, and the teacher may offer further explanations and elaborations to help understanding. But it offers no direct practical experience. To support a more complete learning process, it needs to offer also:

- a task goal
- a working environment for the learner to practice their actions
- meaningful feedback on their actions in relation to the goal
- the opportunity to revise and improve their actions
- the encouragement to adapt and reflect in the light of experience

To this extent that is does not have these features, valuable though it is, the online conference must be integrated with other teaching methods to support the complete learning process. The same is true of all the other methods formally equivalent to it, in terms of the CF: the face-to-face tutorial, the seminar, the small group discussion, the peer group discussion, the question-and-answer session, the video-conference, the discussion board, the email discussion, the chat-room, etc. There are important pedagogical differences, however. Asynchronous discussion formats allow a lot more time for reflection before responding than synchronous ones. The different technologies involved permit different sized groups, and there are important differences between textual, aural, and visual forms of communication in terms of level of engagement. The talking-heads format of a large-scale and highly visual video-conference is likely to be far less engaging than the one-to-one engagement in the stripped-down communication environment of email. The CF does not make any of these distinctions. It does not need to because they are related straightforwardly to the well-known design features of each method. For all of them it says simply: what else will you put in place to support the remainder of the learning process that links the discussion to the practice of the theory, or the application of the idea? As for the online conference, all these 'discussion methods' need to be complemented by additional teaching methods.

Applying the CF to conventional, non-technology-based teaching explains why we have always had a mix of methods – lectures, class demonstrations, practicals, seminars, tutorials, project work, essays, problem classes, role plays, small group work, field trips, private reading - together these combine to provide a rich coverage of the full learning process. But they all have limiting features with respect to the ideal learning experience of the one-to-one guide and tutor, and we look to technology because it can embrace more of the learning activities needed, in qualitatively more effective ways, more flexibly, and on a larger scale.

The CF can be used, therefore, to specify the requirements for an optimally effective learning experience. It is designed to help the teaching community rethink their teaching – what is the best way to help their students learn through conventional methods, digital methods or, better, a mix of the two?

Is it feasible to expect the rethinking of teaching? How is it possible for the teaching community to design the kinds of interactive, adaptive, reflective, discursive, and collaborative uses of learning technology that can support the ideal of personalized learning? Already stretched to meet increasing management demands, the teaching community is hardly well placed to embark on a major reorganization of their teaching.

What does the teaching community need to help them personalize learning?

There is constant pressure to rethink the curriculum, cope with new kinds of learners, and adjust to larger numbers. If we add to this the complexities of embracing the potential of learning technologies, then coping with change becomes the major focus of the teaching community. It makes it the more important that the teacher be a reflective practitioner. Otherwise their role reduces to purely instrumental responses to the latest demand.

The ideal of the reflective practitioner is someone who has the means to learn continually about how to do their job: to learn from others, innovate, experiment, learn from users, and articulate and disseminate what they have learned. This does not sound familiar as a description of how the teaching community operates, but there is a model within education.

Consider the academic's role as researcher. This has developed within the modern university to be recognized in terms of a widely accepted range of critical capabilities and activities (Diana Laurillard, 2002a). In the same way as researchers, academics are consummate reflective practitioners, able to respond to and contribute to rapid advances in their field, building on others' work, sharing ideas and results, moving forward collective knowledge and understanding. But if we test the practice of teaching against those same criteria, none of them, typically, apply. The ideal of the reflective practitioner (Schön, 1987), or the peer in a community of practice that seeks to progress knowledge (Wenger, 1999), or a teacher researcher in the tradition of action research (Noffke, 1994), is very far from the reality of teaching practice. Teachers and academics are not encouraged to be, and are not supported in the kind of reflective practice of teaching that moves the field forward. They may choose to do it, and many in the teaching community do – this where innovative teaching ideas come from – but they are not well supported in doing so.

The teaching community can only manage effectively the degree of innovation being demanded if we find ways of making teaching more like research. As researchers progressively build the knowledge of their field, so teaching must build the knowledge of what it takes to support learning. To progress, teaching needs to be problematised, exploratory, apprenticed, built on the work of others, experimental, subject to revision, with frequent sharing of ideas and solutions, communitarian in approach. It has to practice the 'scholarship of discovery' (Boyer, 1990), or more explicitly, the 'scholarship of engagement' (Kreber, 2005); it has to treat teaching as 'professional learning' (Knight, Tait et al., 2006); it has to foster a form of action research, with teachers as "professionals who theorize in practice", and who in turn foster the learner's search for their own meaning (Noffke, 1994). And like research, it needs time.

Technology is certainly part of the problem here, as it impacts increasingly on the conduct of education. It is new, ever-changing, expensive, difficult to master, complex to manage, wide-ranging in its potential, disruptive of existing systems. And although there is usually funding for the hardware and infrastructure, there has never been, at least in the UK, commensurate funding for staff development, training, content development, and research. The argument here is that technology could also be part of the solution. But the solution has to be responsive to the teaching community's perceptions of what they need. As Goodyear observes:

> In general, the demand from academic staff is for help with design - for customisable, re-usable ideas, not fixed, pre-packaged solutions. However, demand is also expressed in ways which emphasise academics' strong sense of being time-poor. There is no visible demand for complex methodologies, approaches which require substantial revision of existing work practices, or methods which require mastery of complex skills or specialised language. (Goodyear, 2005)

The same is true across all education sectors: teachers who want to innovate want control over the process, not the uncritical adoption of others' products. They need the tools, resources, and environments for access to others' ideas and outputs, but also to support their own innovation, changing others' design, exploring, experimenting, adapting, reflecting and collaborating. But sharing knowledge about teaching is not easy: how do you share your findings with others? To what extent do learning designs migrate across topics, intended learning outcomes, disciplines and sectors?

Is learning design transferable?

When teaching was an activity that took place only behind the closed doors of a lecture theatre or classroom, it was reasonable to suppose that all teaching sessions could be hand-crafted by the teacher, for that context. Teaching ideas were embodied in text-books, but teachers used them as part of their own teaching plan, or learning design, not as a blueprint for how to teach. Technology introduces a wide range of new kinds of resources for teaching, but also creates the huge challenge of how best to design these resources for all levels and disciplines across the curriculum. If learning design remains a hand-crafted, context-specific exercise, it means that we continue a system in which every teacher is repeating the design work being done by the thousands of other teachers also responsible for that topic at that level. It is a system that has little hope of making significant progress in learning design, and is ill-suited to the kind of rethinking and opportunity for innovation offered by technology. An alternative system, capable of innovation from within, would support teachers in sharing and collaborating on learning designs. Generic designs capable of migrating across disciplines, across learner groups, across education sectors, and across physical and digital environments, would enable teachers to build on each others' ideas.

Teachers are resistant to the idea of generic learning designs, because they would appear to ignore the crucial subject-specific detail of pedagogy. However, any theory of learning will necessarily generalize at some level, leaving to the teacher the task of interpreting the general for the specific case. It takes a good teacher to find the right everyday analogy when introducing an unfamiliar concept, but the basic principle of using analogy is a pedagogic technique generalisable across all subjects (and also equally risky in all subjects, due to over-generalisation or over-specialisation of the analogy).

Education has many existing examples of generic learning designs, to act as models from the conventional forms of teaching:

Textbook

- text on paper, organised into chapters with titles, paragraphs, notes, illustrative diagrams, footnotes, exercises, answers, contents list, page numbers, indexes, bibliography, further reading

Lectures

- one to many, one room, raked seating, tables for note-taking, presentation equipment, demonstration facilities

Essays

- topic defined, reading list, word length, text on paper, explicit structure, explicit writing style

These models have been honed to an optimal format over the centuries of teaching provision, and have by now migrated to all disciplines and levels of education. Similarly, at the level of learning activities designed to meet particular learning objectives, there are also many generalisable pedagogic forms:

To get learners thinking through their own ideas

Set a task for individuals to make notes on a topic for 5 mins

Combine as pairs to agree on two points to make

Combine pairs as fours to compare ideas and propose one

In plenary - discuss ideas from all groups

To generate questions in a lecture

Set up buzz groups to discuss an issue for 3 minutes

In plenary - ask for questions or comments

To help learners understand how something works

Provide the tools and simple goals

Ask them to build their own

Compare and discuss results

Compare with a working version

Again, all these define generic forms that can migrate across all disciplines, topics, and levels. Each one will be customized to a specific topic – the teacher has to define the topic, provide the tools, goals and working versions for comparison – but the principle is the same, *the form captures the pedagogy*, and it is the teacher's task to interpret the form and customize it to their specific context. In this sense, generic pedagogic forms are commonplace throughout education.

Can technology support the transfer of pedagogic design?

The same principle should transfer to the digital context. The design of learning activities within the digital environment would be more feasible if the teacher could work on the basis of an existing format, which captures a particular pedagogic form, and customize this to their context using their own texts, topics and digital assets, or making use of digital assets located in collective repositories of learning objects. We are not very far along that road as yet. The SoURCE[3] project, for example, demonstrated that although pedagogic ideas within a format may be reused, their instantiation in software does not travel so easily (D. Laurillard & McAndrew, 2003). The University of Wollongong's Project: Information and Communication Technologies and Their Role in Flexible Learning offered a formal description of learning designs, with related generic designs (Oliver, Harper et al., 2002). Each general pattern is defined for a form such as 'explore, describe, apply', a detailed flowchart for the sequence of learning activities, and detailed descriptions of 'Tasks' (e.g. problems, projects, investigations), Resources' (e.g. books, case studies, weblinks), and 'Supports' (e.g. schedules, procedures, mentoring). They were not instantiated in software, but as textual descriptions (http://www.learningdesigns.uow.edu.au/index.html), each illustrated through exemplars from different subject areas. There seems to have been little take-up beyond the project itself. The Pedagogical Patterns project is similar in that it collects textual descriptions of tried and tested pedagogical patterns (http://www.pedagogicalpatterns.org/), developed for computer science, many of them described in a sufficiently generic way that they could be applied to other areas as well. Here the main descriptors are

Problem/Issue – learning need, objective or outcomes the pattern is designed for

Audience/Context – the type and level of course it is designed for

[3] SOftware for Use, Reuse and Customisation in Education

Forces – insights into learner behaviour, needs, problems that lead to the design

Solution – description of the sequence of activities to be set up by the teacher

Discussion/Consequences/Implementation – hints and tips for teachers by teachers

Special resources – what the teacher must provide

Related patterns – which other patterns can be combined or embedded in this one

Example instances – a list of topics for which the pattern has been used successfully

Contraindications – when it might be inappropriate to use the pattern

References – to relevant research articles

More recently, Goodyear takes a similar approach, offering design patterns for learning categorized in terms of 'tasks' (e.g. discuss, assess), 'organisational forms' (tutorial group, project team), and 'resources' (e.g. virtual library, chat room), as a way of capturing the pedagogy (Goodyear, 2005). In each case, the intention is to enable academics to begin design with pre-existing generic forms, and for both the 'Flexible Learning' and the 'Pedagogic Patterns' projects, to share these through a web-based community. Neither has so far generated that hoped-for community of innovative teaching practice.

The move to content repositories, housing small chunks of learning as 'reusable learning objects' (e.g. video clips, diagrams, runnable models, pictures of artifacts, etc.) reflects the hope that content with pedagogy stripped out may be more easily transferable among lecturers. The work has generated a lot of digital material with the potential to be housed in learning management systems, as in the COLIS[4] project (Dalziel, Philip et al., 2005), and JORUM[5] (http://repository.jorum.ac.uk:80/intralibrary/Login), and the wide range of digital library material now becoming available. However, use of these repositories by academics and teachers remains low. The joint NSF/JISC[6] project 'Digital Libraries In the Classroom' was set up explicitly to encourage and generate use of existing digital repositories (http://www.jisc.ac.uk/index.cfm?name=programme_dlitc). Of course, relying on digital *content* for transfer of innovation would run counter to the idea of enabling academics to negotiate, share, and explore the pedagogic *forms* made possible through new technologies. This is essential, if they are to maintain control of developing pedagogies. The argument in this paper is that we should be aiming to use the technology to transfer pedagogic ideas as well as the chunks of content, and the hope remains alive in, for example, the DialogPlus Toolkit (http://www.dialogplus.org/), the LADIE[7] project (Conole, Littlejohn et al., 2005), and the TASS[8] project, (Green, Jones et al., 2006). However, if we could find a way to encourage the community of pedagogic practice to develop, this would create a demand for digital resources needed to populate the learning activities being designed.

One promising development in this direction is the Learning Activities Management System (LAMS), designed at Macquarie University, and being piloted in several schools, colleges, and universities in the UK, as well as in many other countries.

[4] Collaborative Online Learning and Information Services

[5] JORUM is a free online repository service for teaching and support staff in UK Further and Higher Education Institutions, helping to build a community for the sharing, reuse and repurposing of learning and teaching materials.

[6] National Science Foundation (USA), and Joint Information Systems Committee (UK).

[7] Learning Activity Design In Education

[8] Transformation, Augmentation, and Substitution Service

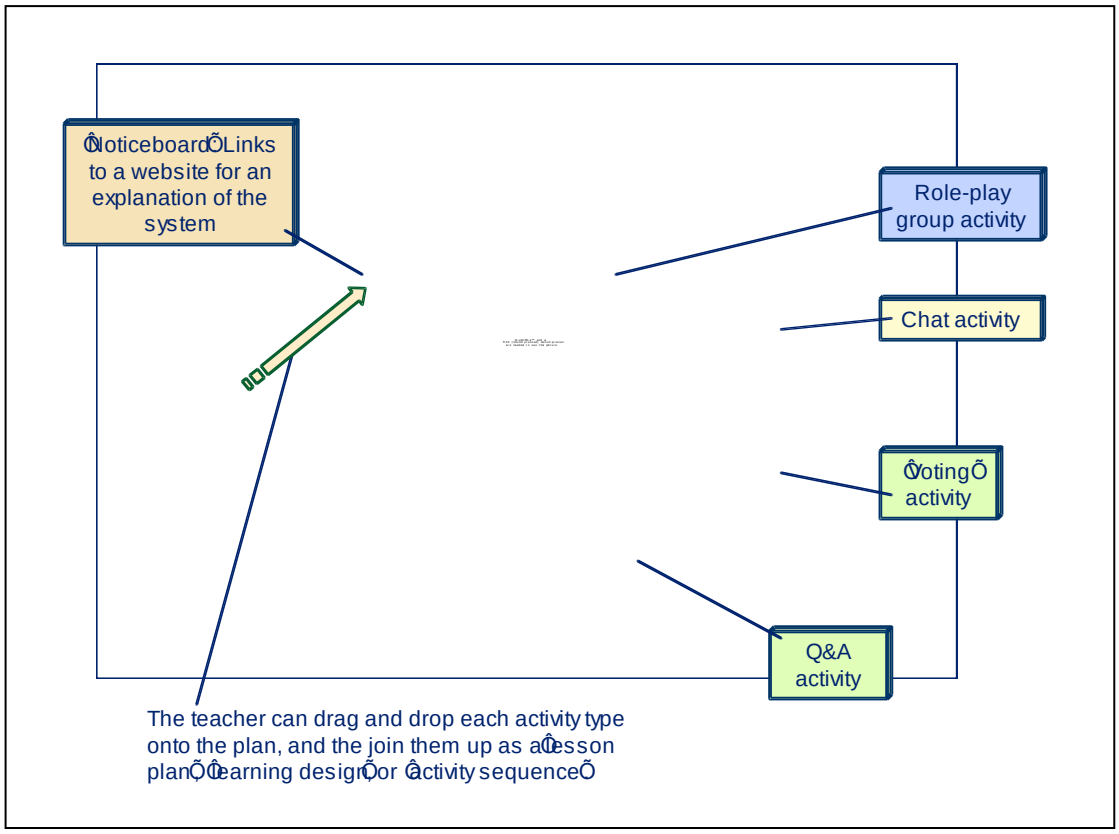

Figure 2: The authoring environment for the Learning Activity Management System (LAMS). The diagram shows a learning design for: 'Understanding processes within a system through a role-play activity to explain it'.

The teacher can drag and drop the pre-defined activities to construct a sequence, edit the instructions within each one, and define the website to be linked to. Thereafter, other teachers can either use the existing design, or adapt it to their own needs.

Evaluation has shown that academics and teachers welcome the functionality it provides for designing and managing sequences of learning activities for individual tasks and group collaboration (Masterman & Lee, 2005), although it may challenge more conventional teachers given its essentially collaborative pedagogy. It is particularly interesting for the current discussion because it captures the form and content of a learning activity in a way that can be shared, reused and customised by others.

Figure 2 shows how the drag-and-drop authoring environment for LAMS enables a teacher to build up a sequence of activities, and edit in their own tasks, digital assets, or existing learning activities, which the system then runs, linking up individuals and groups of students.

The simple and highly flexible interface makes it relatively easy and enjoyable for teachers to design and run their own learning sequences, either in a wholly digital environment, or mixed with class and face-to-face activities. Once the sequence is designed, it can be saved either in a private folder, or published to a wider community. Each sequence developed captures the generic aspects of its pedagogy in its form. If an existing sequence is adopted by a teacher, the form may remain the same, but the specifics – the topics suggested for debate, the resources to be accessed from the sequence, the questions put to students, etc. - are all chosen by

the teacher. Having run the sequence with groups of students, the teacher may decide that the sequence needs adjusting, - by reordering, or adding further activities, for example – and can easily make those changes in the same drag-and-drop authoring environment, and run it again. This iterative 'design – test – re-test' process should enable improvement on the pedagogic form, in which case it can be published for the benefit of others, both in its specific and its generic form. The benefit to the community is that a practice-based design, the pedagogy now captured in the generic form, is available for others to build on and refine. The process provides the kind of 'activity system' that lecturers need to progress their own development. As Knight et al point out, their knowledge of good educational practice is lost unless "they have tools or heuristics to help them cast their generalised understanding… into some practical shapes" (Knight, Tait et al., 2006). The LAMS Community environment (www.lamscommunity.org) provides a website where teachers can publish their sequences, download others' sequences, and post their reviews of the quality of the sequences they have used.

The LAMS approach – both the authoring environment and online community - provides one of the few ways currently available to support lecturers and teachers as reflective practitioners in their exploration of learning technologies, as individuals and as communities of practice (Lave & Wenger, 1991; Wenger, 1999). Testing its characteristics against the research capabilities outlined above, we can see that this kind of approach can support several of them:

building on the work of others – by making tried and tested learning designs available to others through the LAMS community;

conducting practical work using agreed-upon protocols and standards of evidence of their field – the constraints of the tools and environment impose certain protocols, and quality standards are defined in terms of practical success of a sequence when run with students;

working in collaborative teams of respected peers – being able to capture pedagogic ideas in a shareable and inspectable form means that teachers can critique and collaborate on design and development of their pedagogies;

disseminating findings for peer review and use by others – the LAMS Community environment enables both dissemination and peer review.

Support for a research-style approach to innovation with learning technologies is possible, therefore, through this kind of collaborative environment, supplemented with access to the interoperable resources and assets gradually becoming available through repositories and digital libraries. The JISC Design for Learning Programme[9] is currently funding a family of research projects to investigate what it takes to enable teachers and lecturers to design high quality and effective learning activities. The overall aims of this programme are to:

- support practitioners in the process of design for learning, in a range of learning programmes and contexts across UK post-16 and higher education.
- ensure that the process of design for learning is based on sound pedagogic principles, is evidence-based and learner-centred;
- promote the development and implementation of tools and standards to support the process of design for learning;
- promote the sharing of expertise in design for learning, for example through sharing and re-use of effective pedagogic designs;

[9] http://www.jisc.ac.uk/elp_designlearn.html

- support the establishment of communities, services and resources to promote and sustain effective practice in design for learning.

The aims are exactly in line with an approach to teaching that is modeled on research practice. Bringing this greater professionalism to the development of learning technologies is essential if the academic community is to both maintain control of the new pedagogies, and find the most creative and effective ways of exploiting what the technology offers. As Mor et al conclude, there is a need for a research approach that combines the traditions of design patterns common in software development with the requirements derived from pedagogy. Each challenges the other, but they argue that "Design patterns have the potential to bridge between these disparate research and practice communities, and allow each one to enjoy the fruits of the other's efforts" (Mor, Winters et al., 2006). The act of participation fosters learning, which in turn fosters change, and the opportunity for the innovation we need (Cousin & Deepwell, 2005).

Generic learning designs in practice

As an example of how such a process might work for the individual teacher, consider the following sequence developed to introduce students to a new procedure, such as an information search. The example is derived from a study of students' approaches to information literacy, which found that, for the undergraduate population studied, there are four categories of approach, characterized as: (i) 'looking for a needle in a haystack', (ii) 'finding your way through a maze', (iii) 'using the tools as a filter', and (iv) 'panning for gold'. One critical difference between the categories was that students operating at the first level were focused entirely on specific words in the target topic (Edwards, 2006). With this detailed analysis of students' conceptions of a task it is possible to set up a learning design whose pedagogy is focused on exactly that issue. The objective, based on the research analysis, is to make students more aware of the comparative effects of different search terms, to encourage them to use alternative words or synonyms. A learning activity sequence to address this objective might look like this, for example, based on the analysis in Edwards' book:

Objective: to raise awareness of the effects of inputs to 'a search engine' on its outputs
Read the text attached illustrating different approaches to using a search engine
The goal is to achieve the output of 'material documenting whether waste products affect the City of Brisbane Bay area'
Select two words to input to the search engine and record your results (the first five urls)
Compare your result with your partner's – which is better?
With your partner, select different words and input these to the search engine – does this produce better results?
Post your best results to the plenary
Vote on which, of all the results, you think are best – you have 3 votes
Submit your explanation of why these are the best results
Vote on which are the best explanations – you have a maximum of 3 votes
Discuss in the chat room what your agreed conclusions are about how to do an information search

As a group, submit your conclusions to the tutor
Read the tutor's responses
On your own, make notes on questions to take to the next class discussion

This is implementable as a LAMS sequence, with students grouped initially as individuals, then as pairs, and then as the plenary group. The system manages the process of taking the students through each stage, managing the discussions, collaboration, and voting. The pedagogic design elicits students' active learning in seven different ways, as

an individual selecting search words

a partner comparing results

a partner collaborating on finding better words

a contributor to the plenary voting procedure

a contributor to explaining the results

a participant in agreeing the conclusions to be submitted to the teacher, and

an individual reflecting on further questions to raise.

This may not be the most effective way of meeting the objective – it may need further refinement. Trialling the sequence with a class, the teacher will be able to monitor its effectiveness, and may add to or revise the sequence. Once refined as a successful learning activity it can be published as a *form capturing the pedagogy* appropriate to this type of objective.

Few teachers will be involved in teaching information searching, but all teachers are involved in introducing students to new procedures at some stage, in particular, raising their awareness of the effects of different inputs on the outputs of a system, or tool, or model. So we could repurpose this sequence for other topics requiring the same kind of treatment. We could therefore also derive the generic version by abstracting the general form, and describing the nature of the specific content to be inserted. The generic version works through the same stages, but with the specifics of the topic now generalized, in bold:

*Objective: to raise awareness of the effects of inputs to '**X**' on its outputs*
Read the text attached illustrating different approaches to using an **X**
The goal is to achieve output '**Y**'
Select two **parameters** to input to the **tool/model** and record your results (**specify which results**)
Compare your result with your partner's – which is better?
With your partner, select different **parameters** and input these to the **tool/model** – does this produce better results?
Post your best results to the plenary
Vote on which, of all the results, you think are best – you have 3 votes
Submit your explanation of why these are the best results

Vote on which are the best explanations – you have a maximum of 3 votes
Discuss in the chat room what your agreed conclusions are about how to **use the tool/model**
As a group, submit your conclusions to the tutor
Read the tutor's responses
On your own, make notes on questions to take to the next class discussion

Other teachers building on this pedagogic form, captured in a published LAMS sequence, would have to define the tool or model (X) in the title box, provide a url for a suitable text of their choice, define the goal (Y), provide a link to the interactive tool or model, and specify the type of parameters and results they want. They would also be providing responses online to the conclusions offered by the group. These are precisely the issues a teacher should be focusing on, together with the choice of base sequence, and the nature of revisions to be made to it. The remainder of the creation and management of the learning design and user interface is done by the system. The design workload for the teacher, therefore, is confined to the kinds of content and pedagogical decisions appropriate to their role. This enables them to innovate and experiment, without too much commitment of time, regulating the amount of innovation they do to what is manageable within their workload, and maintaining full control over their teaching.

On the basis of this example, it is now possible to test a LAMS sequence of this kind against the requirements of the Conversational Framework. In this case, the sequence is supporting:

- a structured discussion environment for pairs and groups
- links to a working environment (e.g. a search engine)
- a task goal (to find appropriate material)
- learner actions (selecting search terms, comparing results)
- meaningful feedback (the different results produced by the search engine)
- learner revisions (revised selection of search terms),
- learners adapting their actions and reflecting on their performance in the light of experience (in the discussion in pairs and group)
- the teacher adapting their responses in the light of reflection on the students' performance, available to them through the monitoring facility

Within the LAMS environment itself there is no interactive tool or model supplied – this is external to the sequence. Full technical integration would not always be possible, but for certain tools, such as a search engine, a simulation, an interactive website or a spreadsheet, it is possible to link to the external file and pass the information back to the LAMS environment by cutting and pasting the results required. The LAMS system itself would not cover the full requirements of the Conversational Framework without linking to an interactive practice tool or model. Equally, the reusable learning objects languishing unused in digital repositories, acquire a new lease of life when lecturers can use LAMS to wrap around them the pedagogy they need, and which only they can design. The combination of form and content then fully supports the learning process.

Further examples of sequences that have migrated across subject areas in this way are available on the LAMS Community website (www.lamscommunity.org). The generalisation of the learning sequence can take place at different levels of description of the objective. In the example above the same information search sequence could be used with the same search engine tool but with many different topics. More generally, it could be used with different tools, such as inputs to a climate model with the goal being to achieve a stable global mean temperature, or inputs to a business model with the goal being to achieve increasing profits, or even synonyms for words in a poem, with the goal being to see how it changes the experience of reading it. In each case the pedagogic form could be quite similar, designed to focus learners' attention on the role and effects of key inputs to a system, tool or model, in the most general sense.

For teachers and lecturers, the idea of pedagogy captured in generic forms is valuable for four reasons:

- existing forms, relevant to particular types of learning objective, offer ideas for new forms of pedagogy in their own subject
- customisable forms can be adjusted to the needs of their own context and learners, unlike most published educational software
- their best teaching ideas, honed with practice, are capturable and publishable, and therefore subject to recognition and evaluation
- lecturers become part of a professional community of practice, able to bring to their teaching the rigorous approach they use in research

These elements offer a practical instantiation of the components of the scholarship of teaching and learning – inquiry, reflection, evaluation, documentation, and communication (Trigwell, Martin et al., 2000). This practical support of the professional community of practice provides for the 'integrity of practice' that enables lecturers to make sense of their situtation in a time of radical change, to articulate their rationale for their approach to teaching and learning, to increase professional collaboration, and to argue their case for a principled approach to education (Young & Irving, 2005).

The practice is already beginning to demonstrate that generic forms in digital environments are feasible. Take-up is easier in institutions where central learning technology units can offer initial advice and guidance on the use of LAMS, until it becomes a familiar technology, much as is done for virtual learning environments. We need more research to test the extent to which this is a viable mechanism for lecturers, and what further tools they need. The JISC-funded project 'A user-oriented planner for learning design' (http://www.wle.org.uk/d4l) is using LAMS to deliver a tool to support lecturers in the process of learning design. In this way, we hope to accelerate the take-up of this kind of approach to the development of new pedagogies for learning technologies.

Concluding points

The demand for lifelong learning throughout developed and developing societies alike will continue to increase, as all countries need a higher proportion of the workforce to be skilled, and all citizens need to be able to master the basic skills of literacy, numeracy, and now information literacy as well. There is no hope that we could generate the teaching workforce that could cope with this demand on the model of our existing educational systems. We have to find cleverer ways of using technology to scale up the quality and value that teachers provide.

Learners at all levels need personalized advice, guidance and support for all the key activities involved in the learning process – listening, reading, discussing, practicing,

experimenting, exploring, adapting, reflecting, producing, articulating, etc. The particular support they need at different stages, in different topics is manifest in the different pedagogical forms that education has developed over the centuries. For the learner, learning technologies offer a wider variety of forms, more combinations of forms, and a degree of personalization. For the teacher they offer also the ability to capture and reuse the pedagogic forms they create. More significantly, through this mechanism, they enable the exploration of innovative pedagogy to take on the character of research – a more robust and rigorous way of developing our knowledge in this critically important field. Digital technologies enable lecturers to build on and share their best teaching ideas – it is the form that captures the pedagogy and technology preserves it. By enabling teachers to act like a research community, being partners for each other in progressing this particular form of professional knowledge, there is some hope that we will then develop the learning technologies that do transform learning, on the ambitious scale we aim for in our education policies.

Acknowledgments

This work is building on research being carried out within the Kaleidoscope Network of Excellence for Technology Enhanced Learning (http://www.noe-kaleidoscope.org/). It will be taken forward through the JISC Design for Learning Programme, which funds the project ‘‘A user-oriented planner for learning design’ (http://www.wle.org.uk/d4l), a collaboration between the London Knowledge Lab (Institute of Education), the Centre of Excellence in Teaching and Learning for Reusable Learning Objects, and LAMS International.

References

Boyer, E. L. (1990). *Scholarship Reconsidered: Priorities of the Professoriate*. San Francisco: Jossey-Bass.

Conole, G., Littlejohn, A., Falconer, I., & Jeffery, A. (2005). *Pedagogical review of learning activities and use cases. LADIE Project Report*: JISC e-Learning Programme

Cousin, G., & Deepwell, F. (2005). Designs for network learning: a communities of practice perspective. *Studies in Higher Education, 30*(1), 57-66.

Dalziel, J., Philip, R., & Clare, J. (2005). *The COLIS Project: Collaborative Online Learning and Information Services.* NSW 2109, Australia: Macquarie University E-learning Centre of Excellence.

Edwards, S. (2006). *Panning for Gold: Information Literacy and the Net Lenses Model*. Blackwood, South Australia: Auslib Press.

Goodyear, P. (2005). Educational design and networked learning: Patterns, pattern languages and design practice. *Australasian Journal of Educational Technology, 21*(1), 82-101.

Green, S., Jones, R., Pearson, E., & Gkatzidou, S. (2006). Accessibility and adaptability of learning objects: responding to metadata, learning patterns and profiles of needs and preferences. *ALT-J, 14*(1), 117-129.

Knight, P., Tait, J., & Yorke, M. (2006). The professional learning of teachers in higher education. *Studies in Higher Education, 31*(3), 319-339.

Kreber, C. (2005). Charting a critical course on the scholarship of university teaching movement. *Studies in Higher Education, 30*(4), 389-405.

Laurillard, D. (2002a). Rethinking Teaching for the Knowledge Society'. *Educause Review*.

Laurillard, D. (2002b). *Rethinking University Teaching: A Conversational Framework for the Effective Use of Learning Technologies* (2nd ed.). London: RoutledgeFalmer.

Laurillard, D., & McAndrew, P. (2003). Reusable educational software: a basis for generic learning activities. In A. Littlejohn (Ed.), *Reusing Online Resources: A Sustainable Approach to e-Learning*. London: Kogan Page.

Lave, J., & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.

Masterman, L., & Lee, S. (2005). *Evaluation of the practitioner trial of LAMS: Final Report*: Learning Technologies Group, University of Oxford.http://www.jisc.ac.uk/uploaded_documents/LAMS%20Final%20Report.pdf

Mor, Y., Winters, N., Cerulli, M., & Björk, S. (2006). *Learning patterns for the design and deployment of mathematical games: Literature review*: Kaleidoscope Project, London Knowedge Lab, Institute of Education.http://lp.noe-kaleidoscope.org/outcomes/

Noffke, S. (1994). Action Research: towards the next generation. *Educational Action Research, 2*(1), 9-21.

Oliver, R., Harper, B., Hedberg, J., Wills, S., & Agostinho, S. (2002). Formalising the description of learning designs. In A. Goody, J. Herrington & M.

Northcote (Eds.), *Quality conversations: Research and Development in Higher Education* (Vol. 25, pp. 496-504). Jamison, ACT: HERDSA.

Schön, D. A. (1987). *Educating the Reflective Practitioner*. San Francisco: Jossey-Bass.

Trigwell, K., Martin, E., Benjamin, J., & Prosser, M. (2000). Scholarship of teaching: a model. *Higher Education Research and Development, 19*(2), 155-168.

Wenger, E. (1999). *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press. .

Young, P., & Irving, Z. (2005). Integrity of practice in lecturers' accounts of teaching decisions. *Studies in Higher Education, 30*(4), 459-472.

Figures

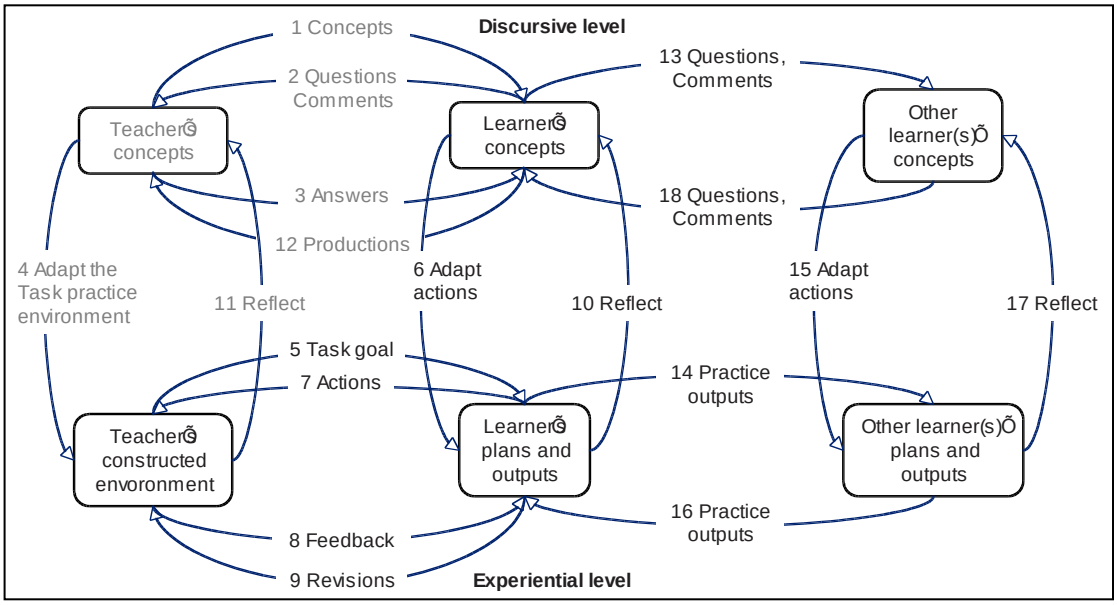

Figure 1: The Conversational Framework for supporting the formal learning process: The diagram shows the minimal interactions between the teacher and learners that would constitute a completely supported learning process, and how an online science collaboration program would not provide complete support.

Those interactions not covered by an online collaboration linked to a science simulation game are greyed out. The teacher will have presented the theory in a different session, and is not present to discuss and answer questions, though they may do this at a later debriefing session (activities 1, 2, 3, 12). Similarly, although they are adapting the students' task environment by selecting the program, they are not present to reflect on their use of it and further adapt the way it is used (activities 4, 11). The value of the Framework is therefore to demonstrate what other teaching methods must be blended with the technology-based methods to complete the support of the learning process.

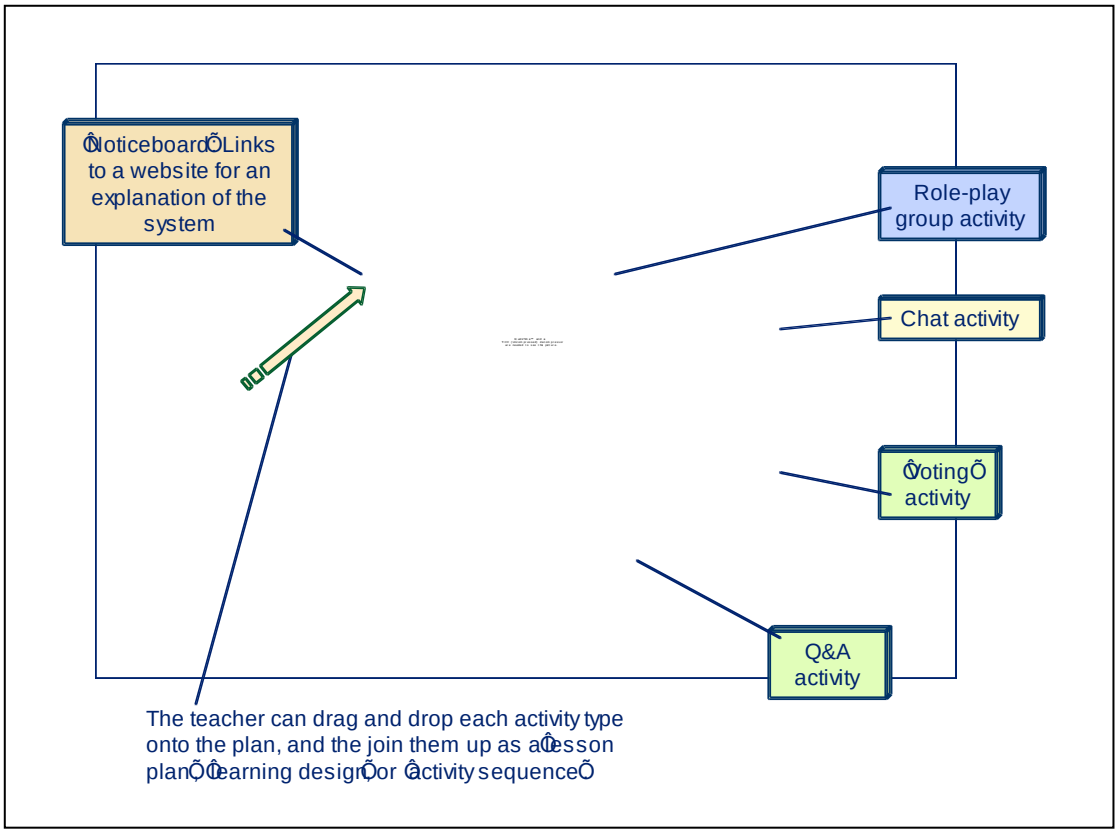

Figure 2: The authoring environment for the Learning Activity Management System (LAMS). The diagram shows a learning design for: 'Understanding processes within a system through a role-play activity to explain it'.

The teacher can drag and drop the pre-defined activities to construct a sequence, edit the instructions within each one, and define the website to be linked to. Thereafter, other teachers can either use the existing design, or adapt it to their own needs.