Pedagogical review of learning activities and use cases: LADIE Project Report

Other

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LADIE project report, August 2005

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Introduction

The JISC-funded LADIE project aims to produce use cases of learning activities through a series of workshops with practitioners (*www.elframework.org.uk/refmodels/ladie*). From these an e-learning framework identifying the services needed to support learning activities will be produced. This review provides part of the background to this work by considering the pedagogical aspects which inform the development of the use cases. The report begins by identifying two gaps; one between the potential of e-learning tools and current usage, the second between the potential of recent learning theories and

the current predominance of didactic modes of delivery, considering the factors which contribute to these. The role of learning activities and use cases in (partially) filling these gaps is explored, supported by a review of the learning theories and models that underpin learning activity development and the taxonomies that allow planning, sharing and sourcing. After discussing how use cases can allow mapping of interactions and support services we finish by noting influential learning theories that learning activities and use cases do not address.

The purpose of the review is:

- 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.

Appendix One provides a glossary of the terms used in this report.

The context of learning

In order to develop mechanisms for supporting the creation of more effective learning activities, we need to first review the ways in which tools are being used to support learning along with a summary of current theoretical understanding of learning and how these might be applied in an e-learning context.

Learning is influenced by a set of inter-related factors. Biggs (Biggs 1999) describes good pedagogical design as ensuring that there are no inconsistencies between curriculum, teaching methods, environment and assessment. Learning activities occur within a particular context (in terms of the environment within which the activity occurs, the pedagogical approaches adopted and the institutional procedures and constraints), and are designed to meet a set of specified learning outcomes and assessment criteria through a series of tasks using a set of tools and resources (Figure 1). Creating the most effective conditions for learning therefore requires an understanding of each of these factors and their relationship. The multitude of ICT tools now available provides new opportunities to enhance learning but also complicates the situation by increasing the set of factors which need to be taken account.

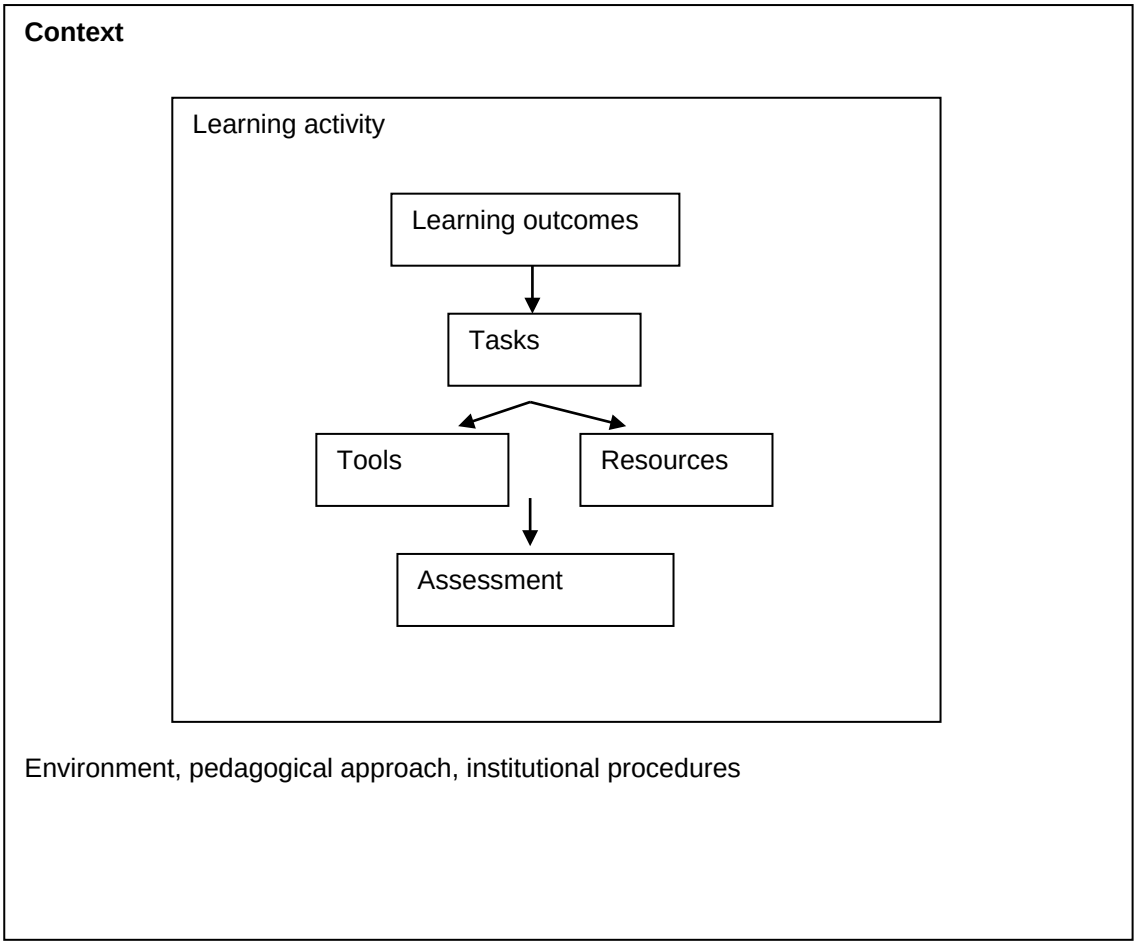

Figure 1: The context of learning

The potential versus the reality

While it is clear that technologies are having an increasing impact on institutions (Conole in press), it is equally apparent that their potential for enabling new styles of learning is not yet being realised (Britain and Liber 2004, Littlejohn 2004).

An inevitable characteristic of technologies is that they are constantly changing and evolving; new technologies are developed and the use of existing technologies evolves over time. Tools can be classified into ten categories according to their main types of use; namely manipulation, presentation, analysis, searching, managing, communicating, visualising, supporting, evaluating and adaptation, Appendix Two provides a summary of these tool types and lists their main characteristics, current usage and impact on practice.

Conole and Dyke (Conole and Dyke 2004) proposed analysing the potential of ICT in teaching in terms of ten 'affordances', which characterise 'those functional properties that determine just how the [technology] could possibly be used' (Salomon 1993); accessibility (i.e. immediate access to information), speed of change, diversity, communication and collaboration, reflection, multimodality and risk, immediacy, monopolization, and surveillance. They suggested that a better understanding of the positive and negative impacts of these affordances might facilitate more effective approaches to e-learning. Boyle and Cook (Boyle and Cook 2004) extended this, suggesting that distinguishing *real* from *perceived* affordances, or *utility* from *usability* might increase the clarity of the analysis. Conole and Dykes' articulation of the affordances of technologies highlights the potential of technologies, but also further demonstrates the complexity of effective use of technologies to support learning

Coupled with this failure to realise the potential of technologies is a failure to implement recent theories of learning. Although there is now a wealth of knowledge about what makes for good and effective learning, on the whole didactic/behaviourist modes of delivery predominate with a focus on transmission of knowledge. Appendix Three provides a summary of the major theoretical perspectives, along with their main characteristics and the ways in which they might potentially be used to support e-learning.

While this second failure is not necessarily dependent on the first – it is quite possible to employ constructivist methods in a traditional face-to-face situation for example or to adapt a Virtual Learning Environment which is designed to promote a transmission mode of learning to foster more socially orientated learning - clearly it makes the task of creating pedagogically innovative learning activities which promote a range of theoretical perspectives more difficult. In the realm of e-learning this will happen only if the e-learning tools are well designed, easy to use and built on good pedagogical principles. In addition, more is needed in terms of mechanisms for supporting the creation of such effective learning activities and bridging the two gaps between potential and actuality.

Mediating forms of representation

In order to create pedagogically informed learning activities which make effective use of tools and theories, practitioners need 'mediating forms of representation' to provide support and guidance (Figure 2). A practitioner is faced with choosing from a bewildering plethora of tools and learning theories in order to create specific learning activities. So, for example, they might use a discussion board coupled with a chat tool to promote dialogic learning, or a shared blog space to promote constructivist learning. The problem is that practitioners are confused by the range of tools and theories and need support in deciding which might be appropriate for a particular learning activity.

There are a range of different types of mediating forms of representation which can provide this guidance and support, such as illustrative examples of good practice (case studies, guidelines, narratives, etc) or more abstract forms of representation which distil out the 'essences' of good practice (eg. specific models, use cases or patterns).

The relationship between tools/theories on the one hand and learning activities on the other is a two-way process. Mediating forms of representation sit between tools/theories and learning activities and can be created from either direction. Therefore it is possible to choose a sub-set of tools and theories through a process of filtering to form a particular representation in the form of a model or use case. Alternatively one could begin with a specific learning activity and abstract out the key essence of the

activity to arrive at the same model or use case. For example use of a discussion board, combined with a dialogic theoretical perspective could generate a use case which uses Salmon's dialogically-based e-moderating model with a set of communicative web services.

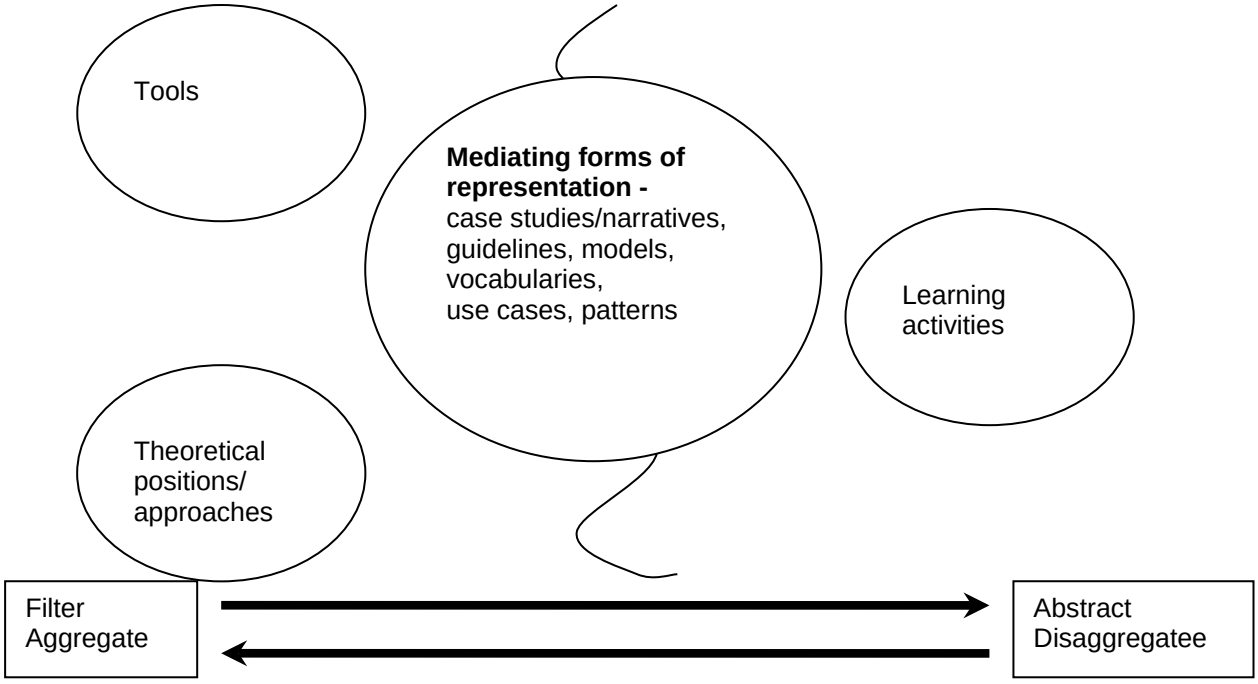

Figure 2. The role of mediating forms of representation

Defining learning resources and activities

This section explores the role of these mediating forms of representation in supporting practitioners in creating learning activities. It summarises research into defining resources and activities for pedagogically informed e-learning; provides an overview of the arguments around the concept of learning objects and learning activities, and discusses how use cases can abstract the structure of learning activities, supporting reuse of generic activities between disciplines and between different e-tools. Also outlined is the associated work on the development of taxonomies that will underpin use case development.

Learning objects

Recent approaches to e-learning have largely focussed around the reuse of resources to develop economies of scale and thus partially address the low usage of e-learning tools. Learning Objects (LO), produced by publishers, teachers, support staff and students, can be stored in digital repositories, where they can easily be accessed, recombined and reused. In an ideal world, there would be a variety of types of objects available for reuse, including information and learning activity resources. These could be adapted to fit different educational models, subject disciplines and levels of study (Littlejohn 2003).

The term 'learning objects' to describe educational online resources began in the mid-nineties, however the term is highly contested and there are now as many definitions of LOs as there are users (Wiley 2000, Polsani 2003); ranging from definitions which limit the use of the term to considering learning objects as decontextualised resources, through to encapsulation of particular pedagogical models and associated learning outcomes. Wiley describes learning objects as 'any digital resource that can be reused to support learning', but stresses that the development of a learning object must be separate from its implementation. Therefore he concurs with Polsani's definition of a learning object as 'an independent and self-standing unit of learning content that is predisposed to reuse in multiple instructional contexts'.

Allert et al (Allert, Richter et al. 2004) extend the notion of a learning object, introducing the concept of Second-Order Learning Objects. They argue that prevalent thinking considers learning objects as 'self-contained and decontextualised resources' and go on to suggest that 'this conceptualisation of learning objects separates the creation and design of learning objects from its use'. They introduce the notion of First-Order and Second-Order Learning Objects (FOLOs and SOLOs). FOLOS are resources which are created or designed towards a specific learning objective and are designed to present information which has to be acquired or reconstructed, whereas SOLOs provide and reflect a particular learning strategy and foster knowledge as they provide scaffolds, schemes, etc.

Mayes and Fowler (Mayes and Fowler 1999) have also developed a more sophisticated approach to appropriate use and reuse of educational resources. Their approach is built on sound pedagogical principles and consists of a three-part conceptualisation cycle which considers learning as a continuous process of refinement of understanding through 'conceptualisation', 'construction' and 'application'; with courseware which supports each stage termed 'primary', 'secondary' and 'tertiary' courseware respectively. They describe the purpose of each type of courseware in terms of this three-part cycle as follows: primary courseware focuses on presentation of subject matter or content, secondary courseware describes the environment and set of tools by which the learner performs learning tasks and finally tertiary courseware is material produced by learners, enabling the reuse of learning experiences by other students. They claim that primary courseware has been overemphasised to date at the expense of providing support for task-based and dialogic learning – which are better articulated through secondary and tertiary courseware.

Learning activities

As Mayes and Fowler pointed out, one problem in focusing on resource reuse, is that teachers tend to plan e-learning around 'instructivist' learning models, which focus on single learners accessing content. Thus, it does not help bridge the gap between current pedagogical theory and implementation. Recent developments in technology allow us to go beyond resource reuse and support implementation of recent pedagogy, in particular social-constructivist learning processes (Britain 2004, Mayes and de Freitas 2004). Interoperable, networked technologies have the potential to support students' collaborative activities, allowing them to source, create, adapt, integrate and store resources in a variety of formats. These new possibilities and affordances of e-learning tools means that it is becoming easier to use technology to support social-constructivist methods of learning, such as collaborative learning through learning communities (Koper 2004). These learning methods focus on the *process* of learning and on the learning activities students carry out in order to gain knowledge of concepts.

A learning activity can be described as:

> *an interaction between a learner or learners and an environment (optionally including content resources, tools and instruments, computer systems and services, 'real world' events and objects) that is carried out in response to a task with an intended learning outcome* (Beetham 2004)

Examples of learning activities include students reading texts, carrying out asynchronous discussions, doing quizzes, or completing short problem-solving exercises (Crook and Barrowcliff, 2003). Other less widespread examples include simulations (Oblinger 2004), role-plays (Bell, 2001; (Salmon 2003), and concept-mapping ((Lee and Nelson 2005); (McGill, Nicol et al. 2005). These types of activities have been developed for reuse across all sectors of education.

Within Higher Education the JISC exchange for learning programme X4L (www.x4l.org/) has supported a number of projects developing new resources or re-purposing existing materials. The national learning network NLN (www.nln.ac.uk/) have a range of resources and activities that have been developed for reuse across the post-16 sector. The British Educational Communications and Technology Agency BECTA (www.becta.org.uk/) and Learning and Teaching Scotland (www.ltscotland.org.uk) have developed resources for the schools and the learning and skills sectors. These can be reused for different groups by the same teacher or by different teachers in different contexts.

Activity planning tools, such as the DialogPlus tool discussed later in this paper, support the design, and in future are likely to support the implementation, of activities grounded in educational theory

The extent to which these resources and activities are reused varies across each sector, largely being influenced by cultural issues (for example whether reuse of materials is common practice) ((Campbell

2003). In addition many activities cannot easily be adapted by tutors, therefore their reuse is limited. If these learning activities were available as reusable activity templates, they could be adapted and contextualised by populating them with content objects to allow tutors to create activities based on a variety of educational models (Laurillard and McAndrew 2003). Ideally teachers would select from a range of learning activity templates. The activity they choose would suit specific needs of their learners, the requirements of the curriculum and e-learning tools available to them (Beetham, 2004). These activities would then be sequenced within a learning design framework: learning design considers the context within which learning takes place and the relationship between the components involved. It is the concept of designing activities that will support student learning, and is familiar in secondary and Further Education as 'lesson planning'.

Lesson plans are a means of formalising learning activities and provide a framework for teachers to reflect in a deeper and more creative way about how they design and structure activities for different students and help achieve constructive alignment between theory and practice ((Littlejohn 2003); (Conole and Fill in press); (Fowler and Mayes 2004)). They are particularly useful in helping tutors to plan *blended learning* (i.e. the integration of technology supported methods with face-to-face teaching), since they can be used to reflect explicitly upon different educational approaches. These are, however, less likely to influence the Higher Education sector, since HE curricula are frequently non-standardised; though increasing emphasis on documentation and quality assurance within the sector may lead to their wider use (Littlejohn and McGill 2004).

There are several benefits of using lesson plans. Firstly, effective learning activities may be shared, thereby creating economies of scale (Littlejohn 2003). Secondly, examples of effective practice may be communicated to other teachers. This could aid tutors, researchers and evaluators in making informed decisions between comparable activities and approaches (Beetham, 2004). Thirdly, lesson plans can be used as a framework for planning for accessibility, since resources can be replaced by other materials that closely match learners' needs. Fourthly, a lesson plan is an effective means of communicating teachers' design requirements to developers. Finally, lesson plans are useful resources for students and can help them reflect on their learning tasks.

Despite a well-established practice of teachers adopting and adapting pre-designed lesson plans, particularly in Further Education, there is no evidence of generic lesson plans being developed and shared without specific subject content (Beetham, 2004). This is partly because it is difficult to abstract an activity that can be reused across a range of subject disciplines (Britain, 2004).

Constraints on the development of reusable learning activities

There are a number of factors constraining the development of reusable learning activities and learning designs:

First, the current development of tools for the semantic web is increasing the possibilities for personalised learning experiences for students (Matthews 2005). One way this can be achieved is by sequencing tasks according to the responses of a learner. However there is a tension between this individualised approach and the increasing development and use of collaborative learning activities with groups of students. Collaborative tasks are most commonly found in University contexts (Collis and Strijker 2004) while individualised approaches are frequently used within the context of business and military training.

Second, teachers frequently do not have the skills to develop activities based on a range of educational models (Beetham, 2004). This results in a gap between application of pedagogy and the effective use of tools and resources. Often teachers and learners view technology in terms of how it will help them *manage resources* rather than *supporting learning* (Timmis, O'Leary et al. 2004).

Third, associated with the third issue, any inability to engage with educational taxonomies through unfamiliarity with the relevant vocabulary makes it very difficult for teachers to search for generic learning activities from other subject disciplines. Teachers would probably have to browse through activities to understand their potential for supporting effective learning. While browsing could be an effective strategy for a single collection of a small number of activities, it would be difficult for wider searching).

Fourth, e-learning practice is moving towards the reuse of generative resources (ie resources developed during learning tasks) (Wiley, 2004). This means that the *outputs* from learning activities should also be considered for reuse. However, most teachers and learners do not have the required e-

literacy skills (for example to archive activities) to allow for effective reuse of learning resources and activities (Littlejohn and McGill, 2004).

Finally, any focus on the development of 'definitive resources' can lead to the production of inflexible materials that do not cater for individual learning contexts. There is a need for tools that allow the teacher to customise generic components to provide a tailored learning experience (Thomas and Milligan 2004). However, there are currently few tools available to allow teachers to support learning activity sharing and sequencing (Britain, 2004).

The use case approach is designed to obviate some of these constraints by abstracting the generic features of learning activities, based on a standardised vocabulary. It is one way of developing the activity templates called for by Laurillard and McAndrew (2003) and Beetham (2004).

Duncan (Duncan 2005) defines a use case as 'a way of capturing the expected behaviour of a system when a person uses the system to achieve a specific goal'. He goes on to state that a use case is a means of communication between people and should be in the form of simple, readable text. He lists the benefits of a use case as being that it:

- defines the behaviour of a system without considering its architecture
- is easy to understand and communicate
- can be used to distil requirements of a system
- can be used to test that a constructed system meets the use for which it was intended.

In terms of developing reusable learning activities, use cases sit between theories and models of learning and e-tools on the one hand, and specific learning activities on the other, and mediate between the two.

The LADIE project is producing use cases of learning activities as a basis for developing an e-learning reference model. JISC holds that "a Reference Model identifies a common learning, teaching, research or business requirement and shows how one or more Services can be used to meet this need." In the specific case of the JISC e-Framework, "a Reference Model provides cross-links to the Services that it uses in the Service part of the e-Framework" (Olivier et al 2005). Collis et al (Collis, Margaryan et al. 2005) define a reference model as 'an abstract description whose entities are described in terms of their main characteristics and where the relationship among the entities is loosely defined'. They see a reference model for learning design as indicating the key components of types of learning approaches that should be reflected in the outcomes of the design process. Quemada and Simon (Quemada and Simon 2003) have developed a use-case based model for learning resources in educational mediators. Their central premise is that in order 'to exchange learning resources via educational mediators, resources need to be described in a coherent manner in order to make systems interoperable and to facilitate reuse'. They have developed a taxonomy for learning resources based on use cases, differentiating between educational activities and resources. Two examples of use cases which were developed in the first LADIE workshop in July are given in Appendix Four, further examples are available at http://www.elframework.org/refmodels/ladie/ouputs/.

Learning theories and models that underpin the development of learning activities

The purpose of the LADIE project is to develop a series of learning activities use cases, therefore it is useful to consider some of the theoretical positions, models and mediating representations that support effective application of e-learning. Examples are described below, along with an indication of their theoretical underpinning. This list is not meant to be exhaustive but to illustrate popular examples which are currently being applied. A number of reviews of theories and models have been carried out; for example Beetham (2004), Conole, Dyke et al (Conole, Dyke et al. 2004), Mayes and de Freitas (2004), Ravenscroft (Ravenscroft 2002), and Thorpe (Thorpe 2002), which provide more details and examples.

It is important to be clear at the outset what we mean by theoretical position, theoretical approach, and mediating representation, and how these relate to use cases. Drawing on Mayes and de Freitas (2004) and Beetham (2004), our terminology expresses four levels of abstraction:

Perspective – this identifies the fundamental assumptions about the processes and outcomes that constitute learning. Mayes and de Freitas identify three perspectives: *associative* (learning as activity), *cognitive* (learning through understanding) and *situative* (learning as social practice).

Theoretical position – describes the position adopted with respect to theories of learning, where we adopt Mayes and de Freitas' definition of theories of learning as providing 'empirically-based accounts of the variables which influence the learning process, and explanations of the ways in which that influence occurs'. This definition seems to encompass the exemplars Beetham has given of what she calls 'approach', or the meaning given to 'model' by practitioners. Theories are generally underpinned by a particular perspective.

Theoretical Approach – Here we include approximately what Beetham has described as a 'practice model', which describes the '*approach* to learning and teaching'. This, she says, is the usage of 'model' as generally employed by practitioners. Theoretical approach generally aligns with a particular theoretical position, and, indeed, one of Beetham's examples, 'a constructivist approach', falls under our 'theoretical position' category. Sometimes, as with 'activity based' models, approaches may partake of aspects of more than one position (Mayes and de Freitas 2004).

Mediating forms of representation - range from those which are more abstract (such as models, use cases and patterns) through to those which are more contextually located (such as guidelines, case studies and narratives). The models included here comprise the more specific of Beetham's 'theoretical models', and 'technical models'. Simplistically, a model is an abstract representation which helps us understand something we cannot see or experience directly. Beetham considers a model to be 'a representation with a purpose*'* with an intended user, and distinguishes 5 usages of the word. 'practice models or approach', 'theoretical models', 'technical models', 'models for organisational change', and students' models. 'Theoretical models' may exist at various levels of abstraction and provide 'a way of explaining or exploring what happens in the learning context', are rooted in research evidence and are explicit about their theoretical perspective. 'Technical models' provide a way of structuring representations, for example in a given code (e.g. XML) or conforming to a given specification or standard (e.g. IMS LOM) .One potential pathway from tools and theories through to specific learning activities is illustrated in Figure 3. A theoretical position or approach can generate a number of models, each model can in turn be translated into a number of use cases; each of which can generate a number of learning activities demonstrating the use cases through the use of different tools/services and resources.

Thus, as Figure 3 shows, a perspective can underpin several theories, while a theory can support a number of models. While a number of learning activities could, and often do, align with each model, interposition of generic use cases enables reuse and easy generation of learning activities instantiating the use cases through the employment of different types of tools/services and discipline specific resources.

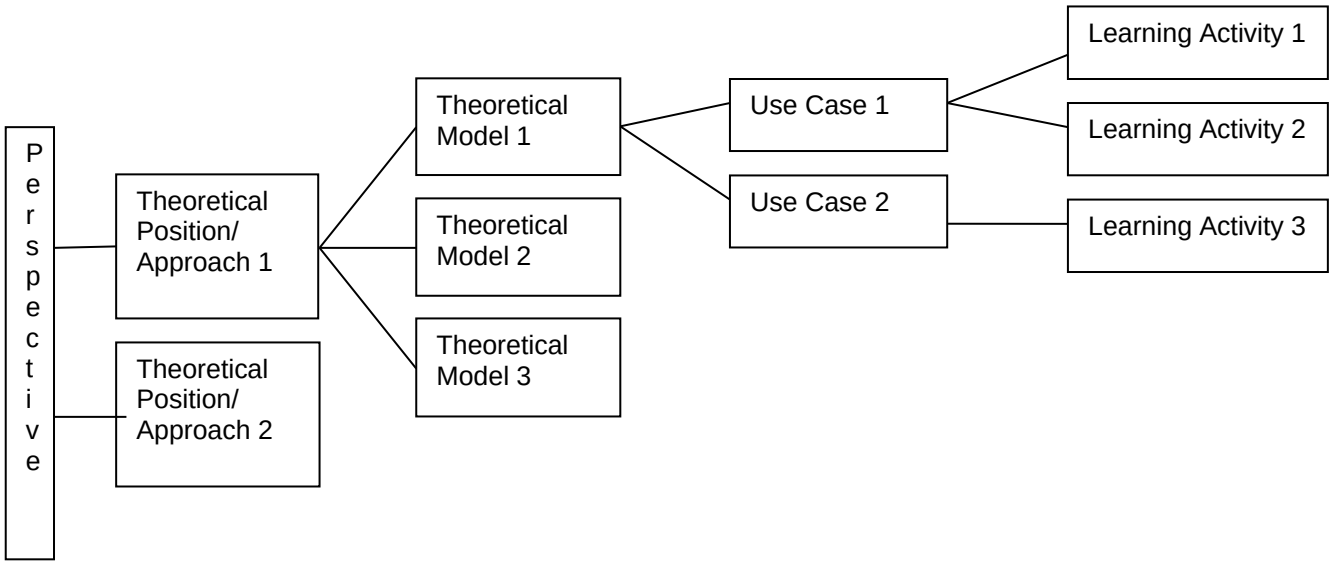

Figure 3: shows the relationship of perspectives, theories, models, use cases (which are a particular form of mediating representation) and learning activities

In practice the alignment is seldom this simple, and there is some uncertainty in the literature about where some models should be placed. Laurillard's conversational model, for example, is aligned with the situative perspective by Conole, Dyke et al (2004), but with the cognitive perspective by Mayes and de Freitas. Figure 4 follows the format of Figure 3 to give a summary of some of the most popular models in use, with an indication of their theoretical alignments.

	Theoretical Position	Theoretical Approach	Mediating forms of representation
Associative	Behavourist	Didactic	
		e-Training	
		Training Needs Analysis	Learning Objects (FOLOS & SOLOS
		Instructional Design	Five first principles model - Merrill
		Intelligent Tutoring	IMS Learning Design
Cognitive/Constructive	Constructive Development	Learning Design	DialogPlus taxonomy
		Cognitive Apprenticeship	CANDLE taxonomy
		Cognitive Scaffolding	8LEM taxonomy
			CASTE system
	Experiential/ Reflective (Dewey)	Learning Cycle/Learning Styles	Kolb Learning Cycle
		Problem Based	
		Project Based	
		Case Based	Laurillard conversational model
	Social Construction (Vygotsky)	Dialogic	e-Moderating - Salmon 5-stage model
			Jonassen's constructivist environment
			Mwanza 8 parameters model
	Activity Theory	Activity Based	3 dimensions of learning characteristics - Conole et al
		Conceptualisation Cycle	
		Systems Theory	
Situative	Community of Practice (Wenger)		SOURCE taxonomy
		Collaborative Learning	SeSDL taxonomy
		Reciprocal Teaching	LADIE use cases

Figure 4 suggests an alignment of learning models to theories and perspective. Mediating forms of representation include use cases, instantiations of theoretical models, taxonomies, and standards, and can all be used to help practitioners design activities

Following the structure of Figure 4, we summarise the main features of these theories and the popular models derived from them.

Associative Perspective

The *associatve* perspective focuses on behaviour modification via stimulator-response pairs, trial and error learning, learning through association and reinforcement, and observable outcomes, and gives rise to *behaviourist* theories. The most influential recent theoretical approach that aligns largely with these theories, is that of *instructional design* based on Gagné's deconstruction of learning into components designed to build up knowledge and skills through a series of steps. Merrill's 'five first principles' model suggests that the most effective learning environments are those which are problem based where the students are involved in four distinct stages: activation of prior knowledge, demonstration of skills, application of skills and integration into real-world activities. To these Collis and Margaryan ((Collis and Margaryan 2005) have added six contextual criteria relating to effective implementation in specific (business) environments: supervisor support; technology support; reuse; differentiation; collaboration; and learning from others.

As noted in the reviews of learning models, a large preponderance of existing e-learning models and tools derive from this perspective.

Cognitive Perspective

The *cognitive* perspective views learning as transformations in internal cognitive structures. Pedagogically, it is characterised by processing and transmitting information through communication, explanation, recombination, contrast, inference and problem solving. It gives rise to *constructivist* and *experiential/reflective* positions.

One mechanism for promoting a constructive environment which has been widely adopted in the creation of e-learning environments is cognitive scaffolding, where the activities which the learner engages with are supported by a series of guidelines to support them and help them to reflect on their actions. Pask and Scott (Pask and Scott 1973) developed the CASTE (Course Assembly System and Tutorial Environment) system to support serial (step by step) and holist (global) learning styles (Ravenscroft 2004). Many e-learning environments provide forms of cognitive scaffolding which guide the learners' actions and promote reflection. This is also the principle on which wizards, such as Word's 'paper clip' are based, by providing the user with support promoted through a series of questions.

Social constructivist theories draw elements also from the situative perspective, in emphasising group construction. An example of a model aligned with these theories is Jonassen's (date) constructivist environment which posits eight factors: active/manipulative; constructive; collaborative; conversational; reflective; contextualised; complex; intentional.

Kolb's learning cycle is probably the best known experiential model. Building on the work of Dewey, Lewin and others, it presents an action-based or 'learning by doing' approach through a four-stage cycle (experience, reflection, abstraction and experimentation). Recently, Cowan has extended Kolb's' learning cycle by considering explicitly how to plan interactive activities to support each of the four stages (Cowan 2002).

Situative Perspective

The *situative* perspective views learning as social participation, and emphasises interpersonal relationships involving imitation, modelling, and the joint construction of knowledge. It views the ultimate objective of learning as to enable us to experience the world as meaningful. Wenger's theory of *communities of practice* is firmly rooted in the situative perspective, whereas *activity theory* also adopts some elements of the cognitive perspective.

Activity theory starts from the premise that activities occur within a context and that this context needs to be taken into account if we are to make meaning of the situation and appropriate interpretation of the results. It enables conceptualisation of both individual and collective practices in the wider socio-cultural context within which they occur. Mwanza (2002) has described a model for activity consisting of eight parameters: activity of interest; objective; subjects; tools; rules and regulations; divisions of labour; community; outcome.

Wenger's theory of communities of practice (Wenger 1998) considers the ways in which communities of practice are formed and developed. He sees four main aspects: learning as community; learning as identity; learning as meaning; learning as practice. This is very much an example of a socially situated theory of learning where learning is seen as social participation.

A specific e-learning model that describes the stages of increasing competence in participating in the community is Salmon's 5-stage framework (2003) for supporting effective e-moderating in discussion forums, which emphasises the dialogic aspects of socially situated theoretical perspectives. Her stages are: access and motivation; online socialisation; information exchange; knowledge construction; development. This model has been incredibly popular and has been taken up and applied extensively. In addition Salmon has reproduced a range of suggested e-activities to promote effective online communication.

An alternative mapping

Figure 3 is far from the only way of mapping learning models. Conole, Dyke et al (2004) have suggested mapping learning models along three axes: individual – social; reflection – non-reflection; information – experience. They contend that designing for effective learning should make explicit which components are fore grounded in different learning activities. By considering the mapping of a particular learning scenario against the three dimensions of information-experience, non-reflection-refection, and individual-socially-based learning the practitioner can see which pedagogical theories best support the activity depending on where it lies along each dimension.

Taxonomies, standards, and tools to allow planning, sharing and sourcing of activities

If learning activities are to be reusable, then they have to be described in commonly understood and standardised vocabulary that will allow users to source and share resources through searching or browsing. Recent and evolving taxonomies form the basis for standardised vocabularies. Differences in terminology between countries imply that both national and international taxonomies should be canvassed to ensure maximum reusability.

The development of international standards for learning technologies has grown in importance in the last five years with the realisation of the importance of and need for interoperability. Current thinking in the development of ICT systems for learning have shifted from the creation of monolithic all in one systems to more of a pick and mix approach, in part in recognition of the constantly changing and volatile nature of this area. This thinking is encapsulated in the JISC's current development of an e-learning framework (http://www.elframework.org/), which is looking to develop a service orientated set of distributed core services required to support e-learning applications, portals and other user agents. The UK is represented in the international standards arena by CETIS (www.cetis.ac.uk). Of most relevance here is the work on the development of standards for learning objects and learning design.

There are a range of organisations involved in the development of standards (see http://www.cetis.ac.uk/static/whos-involved.html for an overview), with the most important being the IEEE Learning Technology Standards Committee (http://ieeeltsc.org/). . There is now a well established standard for learning objects (http://ieeeltsc.org/wg12LOM/), although aspects of this are highly contested, in so far as the definition begins to try and consider the pedagogical aspects of the use of learning objects. Anido et al (Anido, Fernandez et al. 2002) have undertaken a review of metadata models provided by the different standards bodies. Metadata for learning resources has been widely discussed (Quemada and Simon, 2003) and indeed contested. It is important to distinguish between models for design and controlling learning process and model for exchange learning resources. Recently a JISC working group has been established which is undertaking a more extensive overview of pedagogical vocabularies. The group is due to report later this year.

A number of projects have attempted to develop taxonomies which are broader in scope than focussing at the resource or learning object level. In particular of relevance here are those which tried to develop databases and associated metadata which in some way encapsulated practice through case studies or exemplars. Some of the most prevalent ones of relevance to this report are described here; a more detailed review is available in Beetham (2004).

The development of UK taxonomies since 2000

The SeSDL (Scottish electronic Staff Development Library) is a library of educational resources in digital format. It is targeted at people who are not web experts and offers a set of simple and straightforward web-based tools

to interact with the library server. SeSDL can be used from any computer with a browser connected to the Internet and does not require any more knowledge of the Internet than normal surfing. SeSDL (www.sesdl.scotcit.ac.uk) was developed as part of the SHEFC-funded ScotCIT programme (www.scotcit.ac.uk) to meet the needs of the Scottish academic staff development community.

The project developed an associated taxonomy to help classify and retrieve resources available within the database. The taxonomy covers the fields of educational development, educational technology, academic management, resources types and subjects, the most relevant of which in the context of this review is the educational development taxonomy. The SeSDL educational development taxonomy consists of the following sub-categories: planning and preparation, instructional design, approaches to teaching, teaching and learning methods, educational environments, approaches to learning, outcomes of education, assessment and evaluation. The educational technology taxonomy is grouped into computer mediated communication, virtual learning environments, groupware, courseware, computer-aided assessment, computer simulation, computer networks, Internet, educational multimedia, human computer interaction, accessibility, embedding technology, legal and ethical issues, standards, and software packages. The academic management taxonomy includes: financial management, planning, personnel management, professional development, project management, and consultancy. Resource types are classified into: bibliographies, case studies, FAQs (Frequently Asked Questions), glossaries, handouts, questionnaires, tests, graphics, animations, multimedia and interactions.

Building on the SeSDL project, the generic LTSN has developed a taxonomy (see Beetham, 2004 for more information) which defines learning and teaching contexts as the environment within which an activity takes place (for example lectures, laboratories, seminars, tutorials). The taxonomy distinguishes between approaches to learning (such as active learning, enquiry-led, or experiential learning) and approaches to teaching (such as small group, team teaching, online or peer group teaching). It also lists the associated skills students need. Assessment includes both the type of assessment and the way it is carried out.

Combining the experience of SeSDL and LTSN, the Source project (http://www.source.ac.uk) developed a Re-usable Electronic Software Library (RESLI) which was a searchable database of case studies on re-using educational software. The database could be searched using keywords or browsed by subject, pedagogy, technology or strategy. Pedagogy was classified by the type of educational environment in which the event occurred (for example independent study, virtual environment or laboratory), the teaching and learning methods used (examples given included collaborations, demonstrations, discussions, small groups, peer teaching, presentation and seminars), the teaching and learning strategies adopted (for example active learning, constructivism, didacticism, experiential learning, resource based learning, situated learning or student centred learning), the educational outcomes (in terms of academic achievement and improvements), the skills associated (analytical, communicative, computer literacy, numeracy, self reflection, time management), and the associated student evaluation (including diagnostic tests, formative evaluation, peer evaluation, or summative evaluation).

Learning and Teaching Scotland have developed a series of controlled vocabularies, partly based on SeSDL, which are used as part of the LT Scotland Metadata Information Model (LTS 2005). This includes details on the target audience (for whom a resource is designed), the educational level, the context of the resource (in terms of the environment in which the resource should be used), the intended end user, the technical format, and the concept, nature, language of the resource. It also considers the principal use of the resource, listing for example classroom teaching, planning and management, support teaching, independent learning, and lesson development (Campbell, Littlejohn et al. 2001).

Taxonomies from ouside the UK

Candle (www.candle.eu.org) has developed a pedagogical taxonomy which considers the purpose, structure, context, tools, objects and roles involved in a specific learning activity based on Reeves' 14 dimensions of learning. It is used across a number of different countries (Pras 2005).

The 8 Learning Events Model (8LEM) from the University of Liege, provides a simplified, practitioner focused type of taxonomy which is in essence a multidimensional model to describe the various learning situations in which students learn; namely that students: create; explore; practice; imitate; receive; debate; experiment; meta-learn (Griffiths and Blat: 2005).

Interlinked taxonomies

Many of the taxonomies discussed so far are essentially atomistic in nature in that they provide a static representation of the components of learning; whereas learning design adopts a more holistic approach. The concept of learning design is generally discussed at two distinct yet inter-related levels. 'Learning design' (small 'l', small 'd') is the concept of designing activities that will support student learning (referred to above as 'lesson

planning'). 'Learning Design' is the same idea implemented as an IMS specification. The important components in Learning Design are based around the concept of a Unit of Learning (Britain, 2004). These components include learning objectives, roles, activities (*learning activities* or *support activities),* activity-structures, environment (including *learning objects and services such as chat rooms, quiz tools etc),* resources and method.

Learning Design

IMS learning design specification developed out of the educational modeling language developed in the Netherlands, which was developed in part to shift attention from a focus on content to process. Koper and Olivier (Koper and Olivier 2004) argue that e-learning specifications (such as the IEEE LOM) consider learning in terms of a process of consumption of content. They acknowledge that current educational practice is more complex and advanced than this and the learning design specification was developed to reflect this. Learning design is defined as an application of a pedagogical model for a specific learning objective, target group and a specific context or knowledge domain. The learning design specifies the teaching and learning process, along with the conditions under which it occurs and the activities performed by the teachers and learners in order to achieve the required learning objectives. LD is based on the metaphor of learning as a play instantiated through a series of acts with associated roles and resources. The core concept of LD is that a person is assigned a role in the teaching-learning process and works towards certain outcomes by performing learning activities within a given environment. The environment consists of appropriate learning objects and services used during the performance of the activities.

IMS learning design includes a series of use cases which focus on the work flow element of learning design which include a description of the activity, the pedagogy, the context, the learning objectives, the roles, the content, the services, the collaborative activities, the learning activity workflow, scenarios and other specific requirements (taken from Beetham, 2004).

Modelling Learning Design requires further levels of representation, including the sequencing of activities into 'units of learning' or 'learning designs'. Activity templates can be sequenced in a linear or non-linear fashion to create 'learning designs', similar to lesson plans (Littlejohn and McGill, 2004). Moreover, individual students or groups of students might interact with activities in different ways, therefore the sequencing of learning activities can allow for personalised learning (Britain, 2004).

Tools for learning activity sharing and sequencing

A recent DfES consultation paper on e-learning strategy highlighted the need for effective learning design tools to help practitioners to design and deliver their own learning activities (DfES). A range of systems were recently reviewed in a JISC report (Britain, 2004):

The Learning Activity Management System (LAMS) is a web application that runs through a standard browser (Dalziel 2005). EDUBOX is a software tool developed by the Open University of the Netherlands (OUNL) that can run learning designs. This tool was recently integrated with Blackboard (a commonly used Virtual Learning Environment). Coppercore is another runtime engine developed by the OUNL.
RELOAD is a Learning Design editing tool and a run-time environment for learning designs that is being developed in the UK. EduPlone LearningSequence is a learning content management system that can be used to build learning designs.. Duncan et al (2005) gives a technical review of tools and standards for learning activities based on the first iteration of the LADIE project.

Besides learning activity sharing and sequencing, tools are currently being used to support teachers in lesson planning. These are useful for mapping design principles to learning outcomes and learning activities (Ravenscroft 2004).

DialogPlus – an e-learning pedagogy toolkit and taxonomy

The JISC/NSF funded DialogPlus project has developed an online toolkit (http://joker.ecs.soton.ac.uk/toolkit/) which guides practitioners through the process of developing pedagogically informed learning activities (Conole and Fill in press). The tool is underpinned by a taxonomy that attempts to consider all aspects and factors involved in developing a learning activity, from the pedagogical context in which the activity occurs through to the nature and types of tasks undertaken by the learner.

At the heart of the toolkit is the notion of a learning activity, which consists of three elements:

- the *context* within which the activity occurs, this includes the subject, level of difficulty, the intended learning outcomes and the environment within which the activity takes place.

- the *learning and teaching approaches* adopted, including the theories and models.
- the *tasks* undertaken, which specifies the type of task, the (teaching) techniques used to support the task, any associated tools and resources, the interaction and roles of those involved and the assessments associated with the learning activity.

Learning activities are achieved through completion of a series of tasks in order to achieve the prescribed learning outcomes. Teaching and learning approaches are grouped into three categories – associative, cognitive, and situative. Learning outcomes are what the learners should know, or be able to do, after completing a learning activity; for example be able to: understand, demonstrate, design, produce or appraise. These are mapped to Bloom's taxonomy of learning outcomes and grouped into three types: cognitive, affective and psychomotor. Appendix Five provides an overview of the learning activity taxonomy used in the toolkit.

The taxonomy developed as part of DialogPlus has been compared with related concepts associated with learning design. In particular it aligns closely with the IMS learning design specification (Bailey et al 2006), particularly in terms of the articulation of the environment within which a learning activity takes place and the associated roles and tools and resources used. In addition it has been mapped to the taxonomy developed by the generic LTSN centre. Appendix Six maps the 8LEM model to the task types defined in the taxonomy and demonstrates that there is a remarkably good fit between the two approaches.

Use Cases - how can these allow mapping of interactions and support services

By describing the structure of learning activities in standardised format and common vocabulary, use cases allow stakeholders (practitioners, systems developers, managers, etc) to communicate their requirements clearly and unambiguously, as well as enabling practitioners to search for and source suitable activity structures.

The use cases in the LADIE project are developed by practitioners, derived from learning activities they use, or would like to use, in four main stages:

- Capturing a summary use case - an overview in a sentence
- Identifying the actors and their goals (people, systems, organisations; stakeholders and their interests)
- Writing a success scenario as a series of steps
- Defining exceptions to each step

An important element of the use case is the specification, by practitioners, of the type of systems they require for their activities, and the interactions with actors and systems, independent of the actual technology that might be used. Taxonomies such as DialogPlus and IMS Learning Design can provide a shared vocabulary and means of defining the activities. Authoring tools, that, for example, linked DialogPlus Toolkit to IMS LD editors with graphical interfaces, allow teachers to modify templates, tune them for specific needs, and exchange learning activities.

Use of standardised specifications by practitioners in the *pedagogy layer*, allows the system requirement for the learning activities to be mapped, in the *process layer*, onto the specific services and interactions available or needing to be developed. It thus provides a way of bridging the gap between practitioners and technical developers, and foregrounding interoperability issues. The *services layer* defines: how services can be called; what information needs to be passed when services are called; the structure of the information passed. Two examples of use cases are given in Appendix 4

What's missing from this approach

An aspect of learning activities is that they often result in artefacts being generated by students. These artefacts have been termed 'generated' (Wiley 2004) or 'second-order learning objects' (Allert, Richter et al. 2004). They are often reusable, either by the student who originally created the resource, other students within a collaborative group or class or by subsequent cohorts of students studying the same topic. For example, work produced in one activity may form the resource for a subsequent activity. This approach moves away from the content-driven philosophy, since it places learners as producers as well as consumers of knowledge. This is particularly important in supporting students' knowledge generation, since the artefacts cannot be pre-designed but emerge during the learning process itself. In fact, Allert, Richter and Nejdl (2004) argue against the positive aspects of pre-planned learning activities, since they view these as restricting important learning processes including production and transformation of artefacts and concepts. In addition, these second order objects

involve a re-articulation of ideas and concepts in the students' own language. The DIDET project, part of the JISC Digital Libraries in the Classroom programme, has examined the creation and use of second order objects in knowledge structuring and its impact on learning (McGill, Nicol et al. 2005). This is an area of learning activity theory that the use case approach does not currently encompass.

Summary

In this report we have 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 are immediately apparent. First, that the relationship between theories, models, and the development of learning activities is a very complex one. Second, that in discussing this relationship there are 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. We have attempted to bring some coherence into 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, might impinge more or less directly on the design of activities. Finally the report highlights 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.

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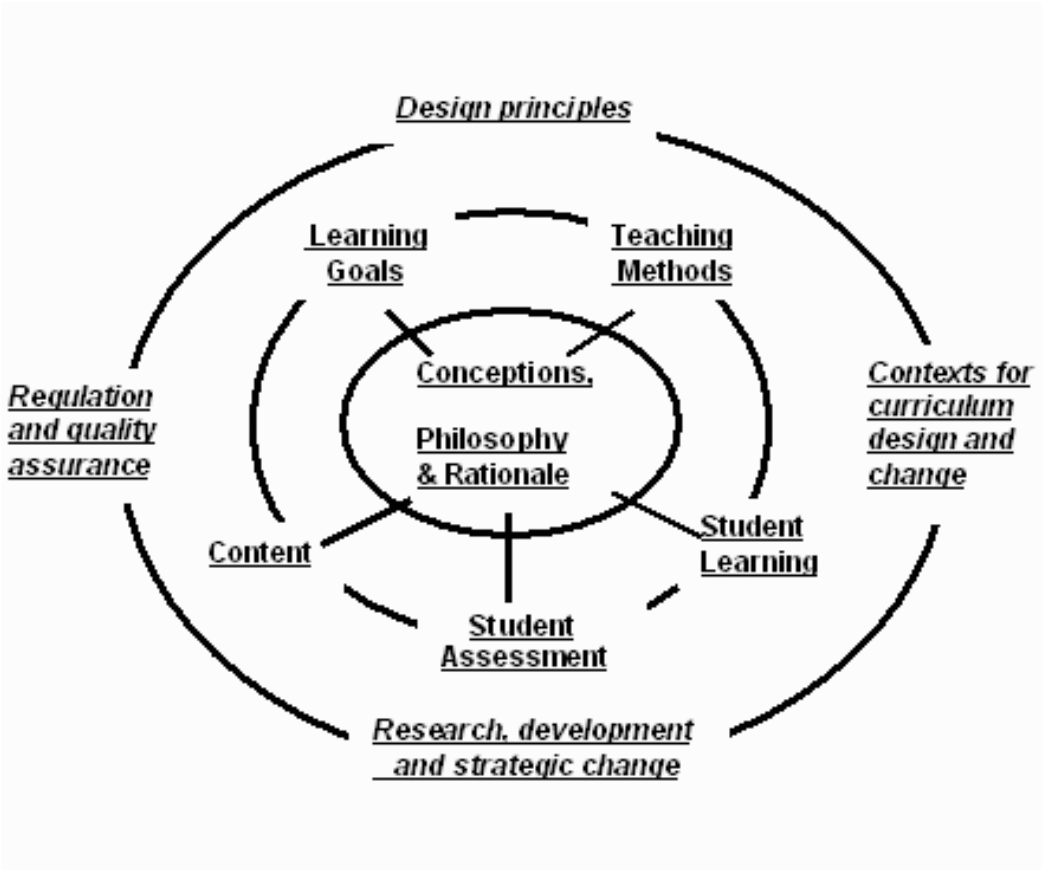
Appendix One - Glossary of terms

Assessment
The process used to systematically evaluate a learner's skill or knowledge level. (www.learningcircuits.org/glossary.html)

Curriculum
Curriculum is the set of courses and their contents offered by an institution.

Curriculum design
Curriculum design is the process of considering the various factors which need to be address in order to instantiate a curriculum. The following diagram from the HE Academy summarises the variable involved.



Definitions of e-Learning
Term covering a wide set of applications and processes, such as Web-based learning, computer-based learning, virtual classrooms, and digital collaboration. It includes the delivery of content via Internet, intranet/extra net (LAN/WAN), audio- and videotape, satellite broadcast, interactive TV, CD-ROM, and more. (www.learningcircuits.org/glossary;html)
This term has been defined in 2002 by the Distributed and Electronic Learning Group for the LSC in England as: DEL (distributed and electronic learning) can be represented as a spectrum ranging from Internet-supported distance learning in which the learner has limited physical contact with the tutor or other learners, to teacher-led, classroom-based activity which is interspersed with occasional computer-delivered or facilitated assignments.
'Get on With IT', the report from the Post-16 E-learning Strategy Task Force in the same year, defined e-learning as: learning with the help of information and communications technology tools.
The DfES consultation document 'Towards a Unified e-Learning Strategy' takes a similarly broad approach:
If someone is learning in a way that uses information and communication technologies (ICTs), they are using e-learning. They could be a pre-school child playing an interactive game; they could be a group of pupils collaborating on a history project with pupils in another country via the Internet; they could be geography students watching an animated diagram of a volcanic eruption their lecturer has just downloaded; they could be a nurse taking her driving theory test online with a reading aid to help her dyslexia - it all counts as elearning.
(Source: http://ferl.becta.org.uk/display.cfm?page=804)

Learning
A cognitive and/or physical process in which a person assimilates information and temporarily or permanently acquires or improves skills, knowledge, behaviors, and/or attitudes. (www.learningcircuits.org/glossary.html)

Learning Activity
An interaction between a learner or learners and a environment (optionally including content resources, tools and instruments, computer systems and services, 'real world' events and objects) that is carried out in response to a task with an intended learning outcome (Beetham, 2004). A learning activity consists of a set of tasks undertaken by a student in a particular pedagogical context to achieve a series of intentional learning outcomes.

Learning Object
Any entity, digital or non-digital, that may be used for learning, education or training (IEEE, 2002)
Any digital resource that can be reused to support learning (Wiley, 2000)
A fundamental idea is that a learning object can stand on its own and may be reused. (Koper, 2001)

Learning Design
IMS Learning Design is a specification used to describe learning scenarios. It allows these scenarios to be presented to learners online, and enables them to be shared between systems.
IMS Learning Design can describe a wide variety of pedagogical models, or approaches to learning, including group work and collaborative learning. It does not define individual pedagogical models; instead it provides a high level language, or meta-model, that can describe many different models. The language describes how people perform activities using resources (including materials and services), and how these three things are coordinated into a learning flow. (Ann Jeffery, Sarah Currier)
http://www.cetis.ac.uk/encyclopedia/entries/20031205162931

Mediating forms of representation
These form the 'glue' that enable practitioners to move from the range of tools and abstract theories available, to specific learning activities and vice versa. They range from those which are more abstract (such as models, use cases and patterns) through to those which are more contextually located (such as guidelines, case studies and narratives). The models included here comprise the more specific of Beetham's 'theoretical models', and 'technical models'.

Model
Simplistically, a model is an abstract representation which helps us understand something we cannot see or experience directly. Beetham (2004) considers a model to be 'a representation with a purpose' with an intended user, and distinguishes 5 usages of the word. 'practice models or approach', 'theoretical models', 'technical models', 'models for organisational change', and students' models.

Ontology
An ontology is a controlled vocabulary that describes objects and the relations between them in a formal way, and has a grammar for using the vocabulary terms to express something meaningful within a specified domain of interest. Ontologies can include glossaries, taxonomies and thesauri, but normally have greater expressivity and stricter rules than these tools.
Ontology - An explicitly specified conceptualisation of part of the world.
Ontology - A set of concepts making up a known universe.
Ontology - A specification of a conceptualization.
Ontology - A formal description of objects and their relationships.

Pedagogy
Pedagogy is the strategies, techniques, and approaches that teachers can use to facilitate learning.
Pedagogy is the study of the methods and application of educational theory to create learning contexts and environments.
Pedagogy is the theory of teaching.

Quality assurance
Quality assurance is the mechanism for ensuring that appropriate standards are being achieved and a good quality education is being offered. Academic standards are a way of describing the level of achievement that a student has to reach to gain an academic award (for example, a degree). Academic quality is a way of describing how well the learning opportunities available to students help them to achieve their award. It is about making sure that appropriate and effective teaching, support, assessment and learning opportunities are provided for them.

Taxonomy
A subject scheme which organises knowledge into a hierarchy. http://www.cetis.ac.uk/encyclopedia/

Teaching
A process that aims to increase or improve knowledge, skills, attitudes, and/or behaviors in a person to accomplish a variety of goals. Teaching is often driven more toward the long-term personal growth of the learner and less toward business drivers such as job tasks that are often the focus of training. Some people characterise teaching as focused on theory and training as focused on practical application.
(www.learningcircuits.org)

Theoretical approach
Approximately what Beetham has described as a 'practice model', which describes the '*approach* to learning and teaching'. Approaches generally align with a particular theoretical position, and may give rise to particular mediating forms of representation.

Theoretical perspective
This identifies the fundamental assumptions about the processes and outcomes that constitute learning. It represents the most abstract level of theory. Mayes and de Freitas identify three perspectives: *associative* (learning as activity), *cognitive* (learning through understanding) and *situative* (learning as social practice).

Theoretical position
The position adopted with respect to theories of learning, This encompasses a few of the exemplars Beetham has given of what she calls 'approach. The position is generally underpinned by a theoretical perspective and may give rise to several theoretical approaches.

Theory
A theory of learning provides 'empirically-based accounts of the variables which influence the learning process, and explanations of the ways in which that influence occurs' (Mayes and de Freitas 2004)

Use cases
A use case expresses the behavioural portion of a contract between stakeholders of a system. It describes the system's behaviour and interactions under various conditions as it responds to a request on behalf of one of the stakeholders, the primary actor, showing how the primary actors goal gets delivered or fails. 'A way of capturing the expected behaviour of a system when a person uses the system to achieve a specific goal' (Duncan 2004). The use case gathers the scenarios related to the primary actor's goal.

Appendix Two – types of tools and their impact on practice

Type	Tools	Characteristics	Impact on practice
Manipulate	Word processor, Spreadsheet, Database	Provide a means of manipulating both textual and numerical data.	Word used ubiquitously Changing roles. Shift from administrator to practitioner for creation of routine documents Changing the way we create knowledge; shift from production of linear 'near' perfect versions of text to documents built up iteratively through extensive use of facilities like cutting and pasting In-built facilities (such as spell checkers) means knowledge is distributed between person and software Enables building on previous work and encourages reuse Offers new forms of joint authoring through shared annotation Enables software to do routine calculations Easy to produce complex and glossy materials and represent information in different ways to emphasis particular points
Present	PowerPoint, The Web, interactive whiteboards, audio or video players	Focus on presentation of materials. More interactive examples include electronic whiteboards which enable group communication and engagement. These can help learners focus and collaborate on certain ideas or processes.	Also transformed the way we create and present knowledge Ability to build on and adapt previous materials In-built wizards provide guidance The web provides easy access to resources and information Issues about new e-literacy skills needed for searching, evaluating and handling information Ownership control possible with software like Adobe PDF format where you can read but not alter text
Analyse	SPSS, NVIVO, Nudist	Software to manage and manipulate complex data sets, allows classification and modelling of both numerical and textual data	Enabling researchers to focus less on routine calculation and more on the analysis of statistical outputs Facilitates management of data sets from large-scale projects, from coding through to sophisticated analysis and modelling Management of large quantities of text, enabling coding, sorting and presentation of text in multiple ways, allowing richer interpretations of data than might have been possible when sorting through piles of paper text May result in a more superficial and less critical take on the data complex operations available are not often fully understood by users

Search	Google, library search facilities	Facilities to query in particular large data sets against specific search criteria	help to make sense of the vast amount of information available over the Internet by provided tailored views or access to sources of information Now used routinely to support all aspects of practice, from finding a colleague's email address or web site to locating resources or reference materials Shifted from a mentality of browsing for materials and use of indexes and tables of content predominant in searching paper-based information, to use of metadata as a means of locating relevant information Search tools are becoming more sophisticated, for example by incorporating advanced filtering facilities and using intelligent and adaptive approaches Criticism is that they are indiscriminate, returning a mix of unrelated items Effective use requires criticality on the part of the user and understanding of the context within which the search is undertaken.
Manage	Bibliographic software Microsoft exchange, PDAs Microsoft Project	Provide a means of storing and managing information. A specialised example is reference management software which provides an effective mechanism for finding, managing and annotating references.	Facilitates powerful searching and managing of data Integrated tools are fundamentally changing practice and the way practitioners manage their time and activities Potential for sharing for example enabling group appointments Dependent on a critical mass of users with a common understanding of how to use them and the perceived benefits. Increasingly being synchronised with hand held devices, such as mobile phones and Personal Digital Assistants (PDAs), extending the range of desktop function on the move Project management become more prevalent in HE More structured approach to setting up and managing of projects

Communicate	Email, discussion boards, chat Asynchronous – email, instant messaging and discussion boards Synchronous – chat, video conferencing, access grid, Blogs, Wikis	Supporting a variety of real time and asynchronous communications through text, audio and video	Focusing on supporting different forms of communication and can be used for a range of functions: brainstorming and questioning, presenting clarifications and explanations, role-play, private one-to-one mentoring or collection of immediate responses to an idea Asynchronous communication tools can be used to promote reflective learning. The major benefit of asynchronous tools is that they allow students to contribute to discussions over a period of time and enables small group work and collaboration. Discussion boards in particular enable the developed of a collaborative discussion around a series of themes and provide the option of archiving of group discussions. The benefit of synchronous tools is the immediacy of the communication. Instant messaging and chat for example are quicker than email and can be useful as a means of one, two or three people communicating quickly about something specific. Requires a critical mass of users Email now routinely supports all aspects of an institution's business Provide a means of extending face-to-face discussions and encourage reflective thinking, provide opportunities for small group work and collaboration Video conferencing and in particular use of Access Grid technologies enable real-time multi-site video conferencing and inclusion of multiple communication channels including data sources and images & sound.
Visualise	Digital image manipulation	Systems which can manipulate and alter images and provide different means of visualisation	Provides opportunity to create and manipulate images Using these to develop ideas and prepare materials, and also, directly with students, to take forward and discuss issues and ideas.
Support	Wizards, toolkits, templates	Systems which provide support and guidance either through online tutorials or step by step instructions and semi-automated tasks	Most software now comes with some form of in-built help system, causing a shift in practice from use of reference manuals to access to help on a contextualised and needs basis Easy to use, but may be restrictive in terms of the type and variety of potential outputs or ways in which the user can interact with the tool
Evaluate	CAA tools, VLEs	Systems which can be used to assess students achievement or monitor and track activities	Enable new means of monitoring users online and more specifically tracking and assessing of student activities Benefits of CAA include the reduction in marking of assignments by tutors and the ability to reuse developed items Many VLEs have in-built tracking facilities which record which pages students have visited and for how long, there are some concerns in terms of the research issues of what information can be gleaned by analysis of the content alone There are concerns about how these tracking devices might be used for other purposes (such as surveillance) or by other agents CAA tools can be used for a variety of purposes such as carrying out surveys or polls or supporting student centred formative or summative assessment. A major benefit is that it is possible to provide immediate feedback on student responses.

Adaptive	Virtual worlds Models	Systems which provide some form of simulation – the environment adapts to the users interactions	An important characteristic here is that they align with the particular culture and activities of the subject domain and to the conceptual approaches and epistemologies

Appendix Three – summary of learning theories and the potential of e-learning

Theoretical position	Theoretical approach	Main characteristics	Potential e-learning applications	Theorist/model author
Behaviourist	Behaviourism Instructional design Intelligent tutoring Didactic Training needs analysis	Focuses on behaviour modification via stimulus-response pairs Trial and error learning Learning through association and reinforcement Pedagogical focus is on control and adaptive response Focus on observable outcomes	Much of current e-learning development represents little more than transfer of didactic approaches online, the 'web page turning mentality' linked directly to assessment and feedback	Skinner Tennant Reigeluth Merrill Gagné
Constructive Development	Active learning Goal-based Cognitive-apprenticeship Constructivist-based design	Focus on internal cognitive structures; views learning as transformations in these cognitive structures Focus on human development Pedagogical focus is on the processing and transmission of information through communication, explanation, recombination, contrast, inference and problem solving Useful for designing sequences of conceptual material which build on existing information structures Focus on the processes by which learners build their own mental structures when interacting with an environment Pedagogical focus is task-orientated Favour hands-on, self-directed activities orientated towards design and discovery Useful for structured learning environments, such as simulated worlds; construction of	Salomon's notion of distributed cognition (Salomon, 1993) could lead to a more shared knowledge structure between individual and surrounding information rich environment of resources and contacts Development of intelligent and learning systems, and the notion of developmental personalised agents The concept of toolkits and other support systems which guide and inform users through a process of activities could be used to good effect to embed and enable constructivist principles Access to resources and expertise offers the potential to develop more engaging and student-centred, active and authentic learning environments Microworlds and simulations	Anderson Hutchins Piaget Schon Papert Duffy

		conceptual structures through engagement in self-directed tasks		
Experiential	Experiential learning Enquiry-led Problem-based Action-based Project-based Reflective practitioner	Experience as foundation for learning Learning as the transformation of experience into knowledge, skill, attitudes, and values emotions. Reflection as a means of transforming experience Problem base learning a focus: Experience: Problem situation, identification and definition Gather and reflecting on information Theory formation and test in practice Experience through Primary and Secondary Reasoning and Reflection Evaluation (Dewey 1916)	Asynchronous communication offers new forms of discourse which is not time-bound and hence offers increased opportunity for reflection Archive and multiple forms of representation of different communications and experiences offer opportunities for reflection	Dewey Kolb Jarvis
Social Construction	Dialogic Argumentation	Emphasis on interpersonal relationships involving imitation and modelling Language as a tool for learning and the joint construction of knowledge Language has two functions: 1. As a communicative or cultural tool, used for sharing and jointly developing knowledge 2. As a psychological tool for organising our individual thoughts, for reasoning, planning, and reviewing our actions: Dialogue between tutor and student can be articulated into 12 levels of engagement – both external and internal	Multiple forms asynchronous and synchronous communication offer the potential for more diverse and richer forms of dialogue and interaction between students and tutors and amongst peers, as well as the use of archive materials and resource for vicarious forms of learning	Mercer Laurillard Lave Salmon Mayes and Fowler Mayes Jonassen
Activity-theory	Activity-based Systems thinking	Focus on the structures of activities as historically constituted entities Action through mediating artefacts within a framework of activity within a wider socio-cultural context of rules and community Pedagogical focus is on bridging the gap	New forms of distribution and storage, archiving and retrieval offer the potential for development of shared knowledge banks across organisations and forms of organisational distributed cognition Models of learning account adaptation in response to both discursive and active feedback	Vygotsky Wertsch Engestrom Senge

		between historical state of an activity and the developmental stage of a person with respect to that activity e.g. current state of language use and child's ability to speak a language The Zone of Proximal Development – the idea that assessing current ability gives limited insight into an individual's potential for development, which is better studied through examining their work alongside a more able peer. Focus on organisational learning, or on modelling the development of learners in response to feedback.		
Community of Practice	Collaborative learning Reciprocal teaching Vicarious learning	Take social interactions into account and learning as social participation. Knowledge is a matter of competences with respect to valued enterprise. Participating in the pursuit of this, i.e. active engagement Meaning our ability to experience the world and our engagement with it as meaningful – is ultimately what learning is to produce	In the last decade there has been a shift from a focus on the information (and in particular content) aspects of ICT to an emphasis on communication, collaboration and understanding the factors which underpin the development of communities. In particular there has been a realisation that the development of content alone does not lead to more effective learning, and that there is a need to structure and foster learning environments to enable communities to develop. Networking capabilities of the web enable more diverse access to different forms of expertise and the potential for the development of different types of communities Different online communication tools and learning environments and social for a offer the potential for new forms of communities of practice or facilities to support and enhance existing communities	Wenger Goodyear Vygotsky

Appendix Four – examples of use cases

Focus	Use case one	Use case two
Authors	Kathy Trinder, Janice West	Graham Bacon, Linda Creanor
Use case summary	The teacher wishes to assist students to consolidate their understanding of child development theory through an experiential approach to interviewing small children	Teacher provides students with a scenario of an imaginary patient in with medical and social problems, with a set of resources on patient care sets up discussion and instructs students to prepare a report recommending treatment regime.
Primary actor (and goal)	Teacher - Consolidation of learning of child development and communication skills.	Teacher - To create problem based learning scenario on patient care
Other actors (and goals)	Student group - Vicarious learning and consolidation Presentation software - Presentation of audio and text resources	Students - Synthesise information and produce report Patient/actor - If multimedia used rather than text to define the scenario Online discussion tool Presentation tools
Stakeholders and interests	Quality assurers - To ensure the students have developed skills as defined above Students - Integrated learning experience Children - More skilled practitioners!	Internal quality personnel Professional bodies
Main success scenarios	The teacher provided written guidelines on the process of interviewing and recording a conversation with a young child The teacher defined the boundaries of the interview in terms of content, length etc The teacher identified a range of appropriate resources to refresh understanding of child development and communication skills The teacher provided arrangements for access to recording equipment. The teacher organised resources within an appropriate learning environment. The teacher defined student group/class for access and when available. The teacher created a section within the VLE to create content and aggregate references to all resources. The teacher created facilities for students to upload recorded materials and written documents. The teacher provided presentation tools for students. The teacher provided discussion tools. The teacher provided archive storage facilities.	The teacher designs a scenario appropriate to particular learning outcomes which is accessible online. The teacher collates appropriate resources on patient care practice and policy. The teacher evaluates and selects online resources. The teacher creates questions to stimulate online discussion around specific issues. The teacher or nominated student moderates the discussion. The teacher guides the students to write a report to be submitted electronically.
Extensions	1. Teacher doesn't know how to make	1a. Teacher searches existing online

	recordings 1a. Teacher seeks guidance on recording equipment 2. Teacher unsure on providing guidelines 2a. Teacher seeks guidance on ethics, interview techniques. 3a. Teacher hasn't authorisation to access materials. 3b. Teacher can't find suitable resources. 4. Teacher cannot provide equipment for students. 4a. Seeks guidance from technologist. 4b. Seeks alternatives for students to borrow equipment 5a. Teacher has no access to learning equipment. 5a. Seeks guidance on tools 5b. Seeks guidance on access for them and the students 5c. Seeks training in tools 6. Teacher unable to organise student access 6a. Seeks technical help 7a. Teacher unable to upload materials, link to references etc. 7b. Seeks expert guidance 8. Teacher unable to set-up facilities for students, to upload their materials. 9. Unable to provide/set-up presentation facilities and tools 10. Unable to provide/set-up discussion tools 11. Unable to provide/set-up archive tools.	scenarios 1b. No appropriate scenarios exist 1c. Text based scenarios lack authenticity * 1c1. Investigate appropriateness of the use of multimedia for presenting the scenario. * 1d. Accessibility of resources/scenarios ** 4a. Discussion questions are piloted through peer (staff) review 4b. Questions are revised in light of review. 5a. Teacher inexperienced in moderating online discussions 5a1. Teacher seeks guidance from staff development team 5b. Discussion doesn't proceed appropriately 5b1. Adapt appropriate remedial strategy 6a. The teacher advises students on the focus of the final report 6b. The student submits a word processed documents for marking 6c. The student submits a presentation display, and presents it at a synchronous online discussion

Appendix Five – the DialogPlus learning activities taxonomy

Taxonomy of learning activities

Context			Activity taxonomy					
Context	**Learning outcomes**	**Pedagogical approaches**	**Type (What)**	**Technique (How)**	**Interaction (Who)**	**Roles (Which)**	**Tools & resources**	**Assessment**
Aims *Pre-requisites* *Subject* *Environment* Computer-based Lab-based Field-based Work-based Audio-based Simulator Video Lecture-based Seminar-based *Time* *Difficulty* *Skills* Creativity Critical analysis Critical reading Group/team work IT Literacy Numeracy Oral communication Practical Problem solving Research	***C*ognitive** ***Knowledge*** State Recall List Recognise Select Reproduce Specify Draw Finding out/discover Pronounce Recite ***Comprehension*** Explain Describe reasons for Identify causes of Illustrate Question Clarify Identify Understand ***Application*** Use Apply Construct Solve Select Hypothesize Infer Calculate Investigate Produce	*Associative* Instructional system design Intelligent tutoring systems Elaboration theory Didactic Behaviourist Training needs analysis *Cognitive* Active learning Enquiry-led Problem-based Goal-based scenarios Reflective practitioner Cognitive apprenticeship Constructivist-based design *Situative* E-moderating framework Dialogue/argumentation Experiential learning Collaborative learning Activity theory Apprenticeship Action research Reciprocal	*Assimilative* Reading Viewing Listening *Information Handling* Gathering Ordering Classifying Selecting Analysing Manipulating *Adaptive* Modelling Simulation *Communicative* Discussing Presenting Debating Critiquing *Productive* Creating Producing Writing Drawing Composing Synthesising Re-mixing *Experiential* Practicing Applying Mimicking Experiencing Exploring Investigating	*Assimilative* *Information Handling* Concept mapping Brainstorming Buzz words Crosswords Defining Mindmaps Web search *Adaptive* Modelling *Communicative* Articulate reasoning Arguing Coaching Debate Discussion Fishbowl Ice breaker Interview Negotiation On the spot questioning Pair dialogues Panel discussion Peer exchange Performance Question and answer Rounds Scaffolding Socratic instruction Short answer	Individual One to one One to many Group based Class based	Individual learner Group leader Coach Group participant Mentor Supervisor Rapporteur Facilitator Deliverer Pair person Presenter Peer assessor Moderator	*Assimilative* Word processor Text, image, audio or video viewer *Information handling* Spreadsheet Database SPSS NVIVO Bibliographic software Microsoft exchange PDAs Project manager Digital image manipulation software Mind mapping software Mind mapping software Search engines Libraries *Adaptive* Virtual worlds Models Simulation Modelling *Communicative* Electronic whiteboards Email Discussion boards Chat Instant messaging Voice over IP Video conferencing	Not assessed Diagnostic Formative Summative

Written communication Ability to learn Commercial awareness Computer literacy Criticism Data modelling Decision making Foreign languages Information handling Information literacy Interpersonal competence Management of change Negotiating Planning and organising Self management Self reflection Synthesis Study skills Critical analysis and logical argument Writing style Library E-literacy Listening and comprehension Making notes Oral	Construct Translate Assemble Demonstrate Solve Write ***Analysis*** Break down List component parts of Compare and contrast Differentiate between Predict Critique Analyse Compare Select Distinguish between ***Synthesis*** Summarise Generalise Argue Organise Design Explain the reasons for ***Evaluation*** Judge Evaluate Give arguments for and against Criticise Feedback Reflect Affective Listen Appreciate Awareness Responsive Aesthetic	teaching Project-based learning Vicarious learning	Performing	Snowball Structured debate *Productive* Artefact Assignment Book report Dissertation/thesis Drill and practice Essay Exercise Journaling Presentation Literature review MCQ Puzzles Portfolio Product Report/paper Test Voting *Experiential* Case study Experiment Field trip Game Role play Scavenger hunt Simulation			Access grid Blogs Wikis *Productive* CAA tools VLEs	

presentation Reading Referencing Research reading Inference and synthesis of information Selecting and prioritising information Summary skill Time management and organisation	Appreciation Commitment Moral awareness Ethical awareness Psychomotor Draw Play Make Perform Exercise Throw Run Jump Swim							

Appendix Six – mapping DialogPlus taxonomy onto 8LEM

The mapping indicates a remarkably good fit. For a number of the tasks types there is a direct correlation; for example all of the DialogPlus 'assimilate' tasks are classified as 'receive' in the 8LEM model. Similarly, 'Communicative' maps to 'Debate', and 'Productive' to 'Create'. Both 'Information Handling' and 'Adaptive' in the DialogPlus taxonomy map to 'Explore' in the 8LEM model. The only category, not surprisingly, where there isn't a direct mapping is the 'Experiential' category in DialogPlus which covers practice, imitate and explore in the 8LEM model. The advantage of the 8LEM model is that it provides a simple practitioner focused list of learning events, which can be used to guide the creation of learning activities. The DialogPlus taxonomy complements this by providing a more details outline of the nature of the types of tasks learners can undertake.

Table 6: Mapping of DialogPlus and 8LEM tasks

DialogPlus task types	8LEM learning events
Assimilative	Assimilative
Reading	Receive
Viewing	Receive
Listening	Receive
Information Handling	Information handing
Gathering	Exploring
Ordering	Exploring
Classifying	Exploring
Selecting	Exploring
Analysing	Exploring
Manipulating	Exploring
Adaptive	Adaptive
Modelling	Exploring
Simulation	Exploring
Communicative	Communicative
Discussing	Debate
Presenting	Debate
Debating	Debate
Productive	Productive
Creating	Create
Producing	Create
Writing	Create
Drawing	Create
Composing	Create
Critiquing	Create
Synthesising	Create
Re-mixing	Create
Experiential	Experiential
Practicing	Practice
Applying	Practice
Mimicking	Imitate
Experiencing	Explore
Exploring	Explore
Investigating	Explore
Performing	Practice