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Mediating between Services and Learning Activities – the User Perspective

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ABSTRACT

We reflect upon the LADIE project's experience of migrating a concept of user requirements from the teaching practitioner community to the technical developer community in the light of literature on 'mediating representations' and 'mediating artefacts'. We show that the practical operation of mediating representations is far more complex than previously acknowledged. We suggest that communities need to overlap, allowing reciprocal communication, to migrate concepts via a representation. If they do not, a chain of intermediate representations and communities may be necessary. Finally, we draw a tentative distinction between mediating representations and mediating artefacts, based not in the nature of the resources, but in their mode and context of use.

Keywords

Mediating representations, mediating artefacts, learning activities, LADIE, reference models, use cases

INTRODUCTION

The multitude of ICT tools now available provides new opportunities to enhance learning (Conole, 2004, Conole and Dyke, 2004). Yet, despite substantial recent investment in trying to exploit the potential of ICT in learning there is little sign that education has changed in any fundamental way (Collis and van der Wende 2002). It appears that the benefits of e-Learning are not sufficiently clear or easy to communicate (Beetham, 2004). Nor are they well enough aligned with existing institutional structures, values and rewards (Seufert and Euler 2004)

A related problem is the failure to implement recent theories of learning. Although there is now a wealth of knowledge about what makes for effective learning, on the whole didactic modes of delivery predominate with a focus on transmission of knowledge. A supposed benefit of learning technologies is their potential for surmounting this problem. However, 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).

The solution to these problems is complex and likely to involve institutional change strategically focusing on transformation in learning and teaching practice, support for staff and students engaging in these new practices and implementation of new physical and virtual learning environments (Littlejohn and Peacock, 2003). A number of these strategic changes are proving difficult for institutions. For example, linking empirically based theory to practice and recognition of valid outcomes aligned to pedagogical theory is challenging for practitioners within current organizational constraints. Similarly implementing necessary changes in working practices and reward structures to provide sufficient levels of practical and educational development support are proving particularly problematic. But all these developments require some sort of translation that makes what the practitioner does on the ground, and its implications, understandable and meaningful in practical terms to those providing the support, facilities and infrastructure (Beetham, 2002). Conversely, the implications of new theories of teaching, and the affordances of new technological tools, need to be translated into terms that teachers and lecturers can put into practice. This translation is frequently achieved through some sort of representation of practice or theory, for example a case study, or model. But it is apparent that different types of representation are likely to be useful and understandable to different types of users – a translation of a teaching practice that informs university management will probably be meaningless to a technological developer. The variety implied by the number of different types of end user becomes even more complex when we consider that any representation also entails an originator, who might also be teacher, educational theorist, learning technologist, administrator, etc.

In this paper we consider these issues of the value of a number of representations to a variety of users by first providing an overview of some previous work on the mediating role of representations, and then reflecting upon our experiences, as part of a JISC-funded initiative (LADIE), in attempting to translate teaching practice across a community boundary into terms that are useful for technological developers.

MEDIATING REPRESENTATIONS

The term “mediating representations” is widely used in knowledge systems and cognitive science disciplines. We define it as encompassing any representation which enhances communication amongst participants and improves their understanding of a concept or practice.

In an empirically based study, Beetham (2001) has discussed the role and usability of such representations in supporting change in teaching practice. She implies a distinction between representations of practice and representations of learning, which might equate to a distinction between representations originated by teachers, and representations originated by educational theorists or psychologists. But in her analysis she treats these on the same footing, being entirely concerned with the end users, in this case teaching practitioners, educational developers and learning technology support staff. While Beetham concentrates only on very limited types of end user, she makes the valuable point that even a single user might have a number of uses or types of interaction with a representation – or alternatively, might require different types of representation to support different sorts of interaction. Her interest in representations as supporting change leads to a classification of six types of interaction (inform, adopt, adapt, create, guide and comment) that implies a learning cycle as practitioners embed the new ideas conveyed by the representation into their practice. Similar cycles have been suggested by Beetham herself (2002), Conole and Oliver (2001), and Mayes and Fowler (Fowler and Mayes, 1999; Mayes, 2001).

Beetham (2001) further characterizes the representations along a spectrum that runs from text, such as articles, reviews and case studies, which are highly informative, to software tools such as assessment tools, which are highly adoptable but less informative. Such a counterposition between inform and adopt does not seem immediately obvious, but Beetham suggests that it is driven by time, or rather lack of it. In a follow-up paper Beetham (2002) adds the nuance that lack of time is a manifestation of lack of suitable institutional and reward structures. She also discusses explicitly the types of representation that might be used by five different communities of users (learner, teacher, resource developer, educational developer, strategic developer), but she has no further empirical evidence to show how these representations do in fact mediate in interpreting practice across community boundaries.

This problem was taken up by Sharpe, Beetham and Ravenscroft (2004) in attempting to investigate the transfer of representations of knowledge between the academic and practitioner communities. However, as in Beetham’s previous survey, the main participants were educational developers and practitioners rather than education academics. The most effective representations cited appeared to be those around which they could interact with colleagues - ie. originators and end users were part of the same, or overlapping communities - a conclusion that is embedded within our definition of a mediating representation as enhancing communication. However, it leaves unanswered the issue of how academic representations made their way into the education developer community in the first place.

Conole (2006) discusses a very similar list of resources to Beetham (see Table 1), but refers to them as ‘mediating artefacts’ in an approach that is rooted in activity theory. Rather than considering them as representations of the practice of a community, she views them as tools for making decisions. Mediating artefacts will help practitioners decide which technological tools and educational theories are appropriate to their situation and aims. Providing support for this choice, it is assumed, will help bridge the gap between recent educational theory and implementation in practice. Despite their different perspectives, however, many of the conclusions of Conole’s survey of mediating artefacts, parallel Beetham and Sharpe’s. For example she draws a continuum from open theoretical maps at one end to restrictive but easy to use software tools at the other end. And she notes that the use of models of educational theory has been criticized because practitioners may not understand how to apply them effectively – she is essentially making the same point as Sharpe et al when they find that the intervention of educational developers is usually necessary between academic theorist and practitioner.

Beetham & Sharpe’s mediating representations	Conole’s mediating artefacts
Review	Narratives

Guidelines	Case studies
Staff development material	Peer dialogue
Case study	Expert guidance
Framework/toolkit – models, templates, etc	Knowledge building
Article/report	Networked communication
Software – learning	Lesson plans
Software – activity shell	Tips and tricks
Software – learning object	Demonstrations
Information resource	Answer gardens
Project/service	Frequently asked questions
Databases	Schema
Bibliographies	Toolkits
Concept maps	Models
	Patterns

Table 1. Lists of Beetham's and Sharpe's mediating representations (based on Beetham, 2001 and Sharpe et al., 2004) and Conole's mediating artefacts (from Conole, 2006).

Like Beetham and Sharpe, Conole is essentially concerned with practitioners as the users of mediating artefacts, although she does mention learners and technical developers occasionally. However, if we view the DialogPlus toolkit as a representation (Conole and Fill, 2005), we begin to see how it might work to mediate between the theoretical and practitioner communities. This toolkit presents practitioners with a range of options to help them develop effective learning activities. However, the theory of learning that underpins the process is hidden from the user. In this case the educational developer has not intervened in person to interpret a model or theory to the practitioner, but has represented their understanding in the toolkit. This highlights the structural difference between viewing such resources as tools and viewing them as representations: the representation view entails communication between at least two participants, not necessarily both from the same community, whereas the tools view hides the role of one of the participants, embedding it within the tool.

Other work that uses the language of mediating representations, such as that of Goodyear and Steeples (1998), similarly concentrates on communication between members of a single, or closely overlapping communities of practitioners and educational developers. However, Beetham (2004), Sharpe et al (2004), Seufert and Euler (2004), Oliver (2004), and Scott (2004) have all highlighted the variety of different stakeholders in learning technology, and the multiplicity of their purposes in using it. These authors have begun to articulate the range of user types, including teachers, learners, technical support staff, technical developers, educational developers, librarians, managers and evaluators. Thus there are many more communities between whom communication is necessary than have been discussed hitherto in the context of mediating representations, although Goodyear et al. (2004) in their work on patterns begin to address the gap between the more widely divergent communities of practitioners and technical developers. This gap has been bridged in practice by the LADIE project.

THE LADIE PROJECT – INITIAL APPROACH

The JISC-funded LADIE project is contributing to the development of the JISC-DEST e-Framework for Education and Research. The e-Framework supports a service-oriented approach to the development and delivery of education. This approach reflects a move from monolithic, powerful, but inflexible Virtual Learning environments (VLEs), towards a more flexible linking of individual 'service' components (such as chat and assessment tools etc) via loosely coupled, standards-based, interfaces. Essential to its development is the documenting of user requirements and processes in a coherent way, and to use these to derive a set of interoperable network services that conform to appropriate standards. The requirements are being documented in the form of 'reference models' that will enable members of the community to collaborate in the development of service components that meet their needs (Olivier, et al., 2005). Thus, it is suggested, a 'reference model'

will provide a mediating representation that enables practitioners and technical developers to communicate about their requirements (Figure 1).

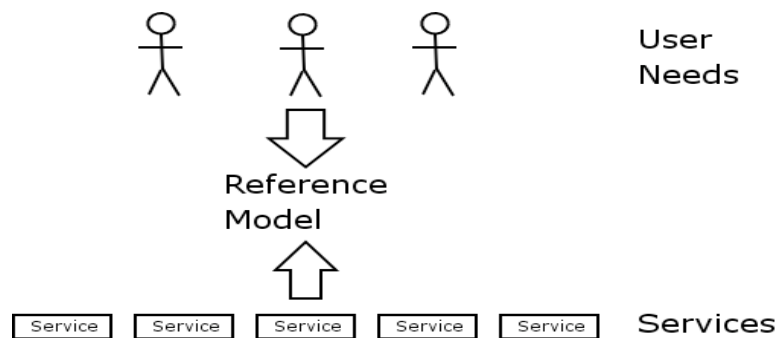


Figure 1. A reference model is a mediating representation that enables users to communicate their requirements for the services system.

A reference model provides:

- An abstract model of what has to be accomplished to meet the needs addressed
- The description of the chosen means of implementing this model - defined by existing and developing technologies, specifications and standards (Olivier et. al., 2005)

The aim of the LADIE project is to develop a learning activity reference model which is firmly based in practical experience of teaching and learning (<http://www.elframework.org/refmodels/ladie/>). In this case the needs are defined as those of effective reusable learning activities. Therefore LADIE is using a ‘top-down’ and ‘bottom-up’ approach, documenting the requirements of effective learning activities in the form of ‘use cases’ through a series of practitioner workshops, and mapping these onto existing interoperability standards and specifications. Use cases are a way of specifying the behaviour requirements of a system, generally in a simple text form (Cockburn, 2001). They are mediating representations that serve to enhance communication about the ways in which the user needs a system to behave (Figure 2).

Use Case Summary	
Teacher runs an online a discussion conference with students	
Primary Actor (and goal)	
Teacher	To administer the discussion conference successfully
Other Actors (and goals)	
Students	To engage in dialogue and develop concepts to pass the course
Moderator	To keep conference running smoothly, both socially and organisationally
Preconditions	
1	System with conferencing facilities
Main Success Scenario	
1	Teacher sets up small group conferences in system and defines student groups
2	System attaches students to teacher-defined discussion groups
3	Students discuss asynchronously in small group conferences
4	Teacher monitors small group conferences
5	System saves records of conferences

6	Students access saved conferences for future work
Extensions	
1a	Teacher is overworked and will not have time to monitor conferences
1a1	Teacher appoints student moderators for conferences
3a	Some messages are inappropriate
3a1	Moderators edit or remove messages
4a	Student participation is low
4a1	Teacher changes conference structure so new messages are more easily visible (eg. by doing away with subconferences)

Figure 2. Abbreviated example of a use case specifying the requirements for running an online discussion conference derived from the LADIE project.

So we can see, already, in the initial project methodology, recognition that two mediating representations, the use case and the reference model, and an intermediate community of learning technologists, seem necessary to bridge the communication gap between practitioners and technical developers, in developing the web services system. The communication looks more like figure 3 than figure 1.

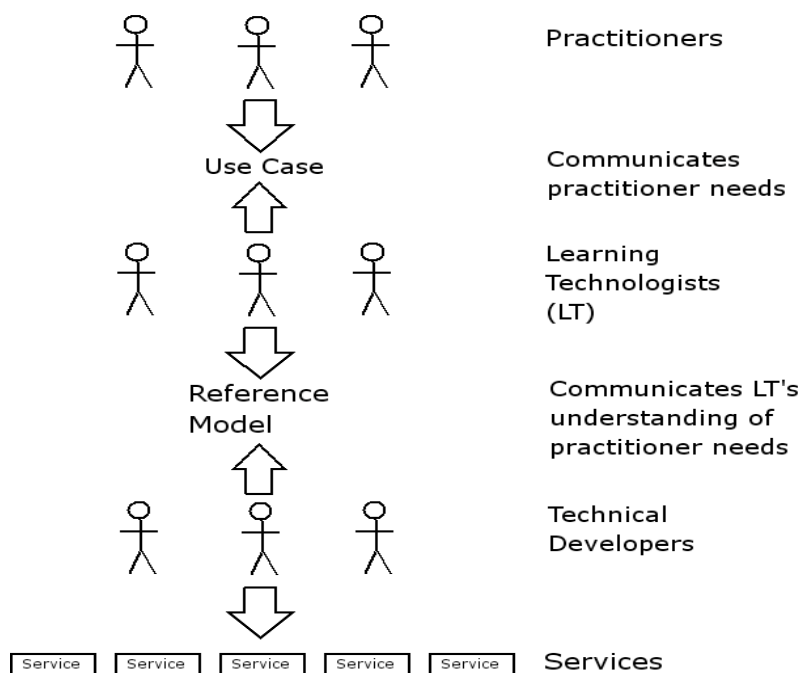


Figure 3. The communication structure and mediating representations implied by the proposed LADIE methodology

THE LADIE PROJECT – OUR EXPERIENCE

The project has documented twelve learning activities to date (December 2005), gathered mainly from two one-day workshops. A further workshop is planned for January 2006. The twenty-two workshop participants have been a roughly equal mix of practitioners from HE and FE, and educational developers. They were known to be e-learning enthusiasts and were invited for this reason. The aim has been to document activities covering a wide range of possible teaching approaches and subject disciplines. Interviews with individual practitioners are being used to fill in disciplinary gaps in workshop participation.

Our initial intention was to get the practitioners themselves to document their activities in the form of use cases, by providing them with templates similar to that of Figure 2, and guiding them through the writing process. We tried this in our first workshop, but it proved extremely difficult to implement in the time available. Even with

the scaffolding provided by the templates, and experts on hand to mediate the process, considerably more experience of writing use cases would be necessary before this community could utilise this type of representation of their practice effectively. The main two difficulties, even for this relatively expert group of participants, were in:

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

In other words, it seemed that the customary practices of this community, which are generally heavily contextualized (refs) and aim to be learner-centred were too far removed from those of the learning technologists developing a reference model for the gap to be bridged by a single representation type, a use case, without a great deal of further and peripheral communication that would bring the communities closer together. Given the time constraints highlighted by Beetham (2001), this means that the representation is unlikely to be effective in this user context.

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

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

- granularity and aggregation – the granularity of a learning activity was the subject of much debate at workshops but most participants settled on something that had a definable beginning, middle and end, generally in the form, provide students with some information, set a task based on the information, report on the result of the task. Such activities comprised a number of different sub-activities (eg. information gathering, discussion forum, report writing) but these tended to be similar from one activity to another. In writing the use cases is often proved more effective to disaggregate these sub-activities and re-aggregate the functionality required of similar ones together into generic use cases such as the discussion shown in Figure 2;
- breadth versus depth – the initial conception of the practitioner-focused team members was that the documented learning activities should cover as wide a range of service components as possible. However, negotiation over the form of the use cases demonstrated that this supposition was based on a false assumption of the sophistication of existing interoperability standards. What the technically-focused team members needed was to develop a core reference model based on an in-depth analysis of the requirements of a limited number of core functions such as discussions and quizzes. The purpose of the case studies, from their viewpoint, was to identify which these core functions were.

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

Thus, the eventual structure and mediating representations that will probably prove necessary in the LADIE project to provide meaningful communication between all communities of users looks something like figure 4. As of December 2005, it remains to be seen whether communication around the reference model is straightforward. It will almost certainly involve some input from the practitioner-focused learning technologists as well as the technically-focused ones.

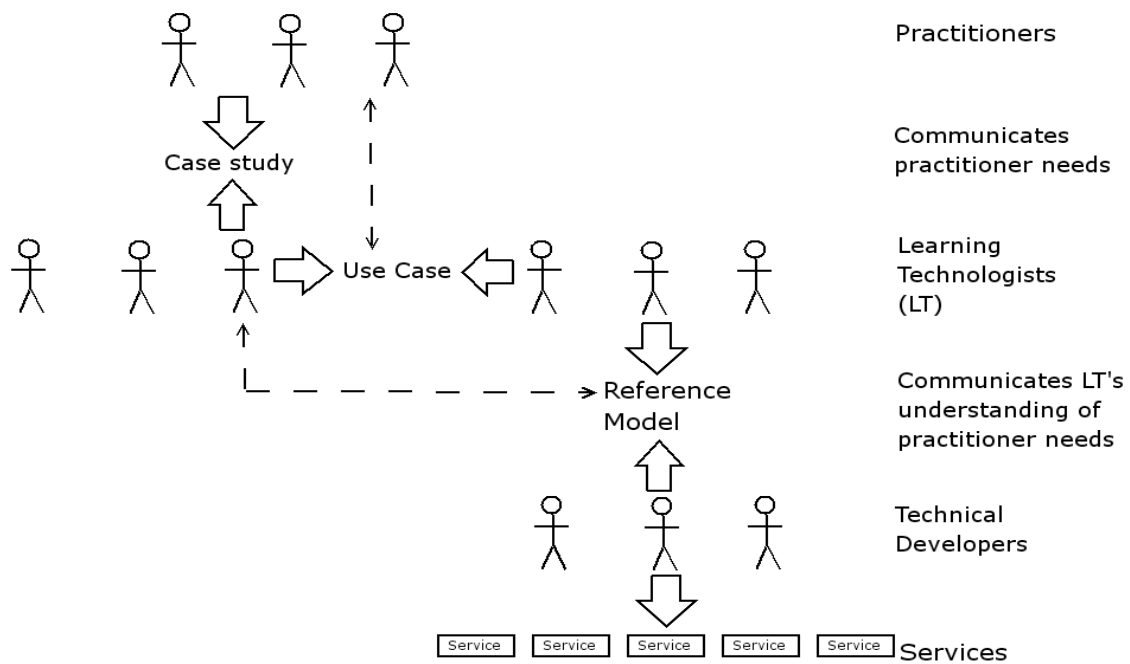


Figure 4. Communication structure and mediating representations used in the LADIE project

However, once the project is complete and the reference model has been written, these active communications will disappear. We plan to write the reference model in three parallel parts, aimed at technical developers, learning technologists, and practitioners, reflecting our recognition that the practices of these communities are sufficiently different that a single representation will not be meaningful to all of them. Once written, and stabilised it is envisaged that the reference model will mediate between users and services as in Figure 1. As in the case of Conole and Fill's DialogPlus toolkit, the role of the originating participants (practitioners and learning technologists) is hidden, embedded within the model, and the model could be viewed as a tool for the user. In this case it might be more appropriate to consider the model as a mediating artefact, in line with Conole's perspective, than as a mediating representation that enhances communication. It remains to be seen, though, whether it will be possible to use the reference model unambiguously in this way, or whether as noted by Conole (2006) such a formalised representation leaves sufficient gaps of interpretation that communication between end user and originator or another 'expert' is necessary for effective use.

CONCLUSIONS

Our experience as users of representations to mediate communication between a variety of communities has shown that the process is considerably more complex than is apparent from previous studies based on single or closely related communities.

In particular, it seems that gaps between some communities, even those united around a common endeavour such as teachers communicating their needs to technical developers, are too wide to be bridged by a single type of representation. In the LADIE project it took at least three communication steps, each centred around a different type of mediating representation, and involving two intermediate communities of participants, to migrate a concept of system requirements from practitioner to technical developer. In each of these steps the communities overlapped: practitioner – practitioner-focused learning technologist; practitioner-focused – technically-focused learning technologists; technically-focused learning technologists – technical developers. The overlap allowed active reciprocal communication between originators and end users around the representation – that this is necessary for migrating concepts is suggested by Sharpe et. al. (2004) and Conole's (2006) work on effective mediation and is assumed in our definition of a mediating representation.

The overlapping communities were sufficiently close in their practices, language and modes of thinking to be able to communicate around the representation within a reasonable time frame. The time-driven constraints on effective representations noted by Beetham (2001, 2002) and Conole (2006) were most apparent at the first stage, documenting practitioners' learning activities. They became less significant at the second and third stages where participants (project team members) were being rewarded explicitly for communicating concepts. In developing the use cases, when relatively free from time constraints, we had representations that seemed both information rich and highly adoptable by learning technologists. However, the same representations proved

neither adoptable nor informative to the practitioner community, and this underlines the obvious point that representations need to be tailored to the practice of their participants.

Finally, we suggest that as the mediating representations reach a stable form and cease to be the locus of reciprocal communication, it may be possible to view them instead as 'mediating artefacts' or tools, in line with Conole's work. Thus, as implied by our initial overview, the distinction between 'mediating representation' and 'mediating artefact' is one of the processes employed and the context of use, rather than of the nature of the resources.

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