Research Design, Roles and Relationships in the ‘Virtual Research Environment for Education’ Project

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Abstract

This paper describes the design of a two-year research and development project funded by JISC under its Virtual Research Environments Programme. The project involved the deployment, development and evaluation of a Virtual Research Environment (VRE) - based on the Sakai Virtual Collaboration Environment - across a group of 10 projects within the ESRC Teaching and Learning Research Programme (TLRP). The primary research question involved exploring the extent to which use of the VRE supported collaboration within and beyond the projects involved, and to what extent this in turn enabled, supported or enhanced research processes and outcomes. Variation between projects and their use of electronic tools (including the VRE) meant, however, that much of the research effort was devoted to understanding the interrelations between personal, interpersonal and institutional factors and 'project' activities. These case studies involved semi-structured interviews, field observations, content analysis, use of routine data such as server logs to illuminate trends in use, and focussed 'co-interpretation' activities. The role of ‘brokers’ or ‘technology stewards’ within projects or at research programme level is also discussed, and the relationships that emerged between researchers and technologists, as these may be critical in contributing to the development and implementation of new technologies in established organisations and networks.

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JISC
Introduction: Background to the Project
Between 2005 and 2007, a group of projects within the ESRC Teaching and Learning Research Programme (TLRP) took part in a formative research and development project led from the Centre for Applied Research into Educational Technologies (CARET) at the University of Cambridge. This project, funded under the JISC Virtual Research Environments Programme, was concerned to develop understanding of the needs of education researchers; to evaluate an emerging software environment as the basis of a Virtual Research Environment to support and enhance their work; and to develop new tools and services based on the developing understanding of their needs.

As such, the project can be located against a number of contexts, developments and policy agendas. In the field of education research there have been calls for an increased role for electronic networking for communication, collaboration and for dissemination as part of a commitment to sector wide capacity building. McIntyre and McIntyre (1999) and Dyson and Desforges (2002) suggest both that expertise needs to be both shared between established researchers and that development opportunities need to be provided for practitioners and new researchers. Training for individuals needs to be complemented by strategies that foster institutional and sector-wide capacity to conduct research, undertake analysis, engage with users and develop innovative approaches.

The ESRC Teaching and Learning Research Programme (TLRP) has, amongst its priorities, development of this capacity – as well as a commitment to sharing research findings and outputs with practitioners, policy-makers and other audiences. The TLRP had recognised the role of electronic tools and networks in supporting these aims, and had, prior to the beginning of this project, already established online community tools, a DSpace digital repository and contacts and events management systems. They were also experimenting with exchange and dissemination mechanisms based around established standards such as OAI-PMH and RSS. This made them an ideal research partner for CARET, which had its combination of research and development priorities and expertise.

Developing Understanding of Diverse Models of Research Activity
Education Research is a 'broad church' within which groups and individuals use a wide range of research and organisational approaches, ranging from biographical and autobiographical research through case study to educational experiments and randomised control trials. The range of
research approaches is compounded by the range of contexts in which education research projects are located (pre-school, school, FE, HE, Professional Learning, Lifelong Learning, Interagency Working), and by a wide variation in relationships between researchers, participants and 'users' of the research. This means that a 'one-size-fits-all' provision of electronic tools or environments would be inappropriate and might even compromise research designs or commitments. Similarly, wholesale importation of approaches from other disciplines or settings (such as e-Science or business use of collaboration tools) might lead to low levels of adoption or to rapid abandonment. Given current debate about the character and quality of education research, detailed exploration of research processes and relationships, both those with and without electronic tools and environments was of interest to a wide range of stakeholders in education research.

**Virtual Learning Environments and Virtual Research Environments**
The Centre for Applied Research in Educational Technologies had been exploring the use of web-based online collaboration tools to support geographically distributed research groups since 2000, including the TLRP, for whom they hosted and developed a dotLRN environment and a DSpace Digital Repository. Within the University of Cambridge it was felt that the functional overlap between dotLRN-based CamCommunities and Course Management Systems (Stanford's CourseWork and Blackboard), was sufficient that a common platform would be desirable. Since Sakai would be the platform to displace CourseWork at Stanford and its modular architecture appeared to offer support for a variety of models of teaching, research and collaboration, it was a strong candidate for a single environment with both VLE/VRE. This also had appeal in the Cambridge context with its close linkage of research and teaching: for example in the context of 'Part II' and 'Part III' undergraduate studies which involve students in research activity alongside formal teaching.

**Virtual Research Environments Within or Across Institutions?**
A further question, which had emerged both from VRE implementations and also from related literatures (such as Wenger, 2001), was what represented the most appropriate model of provision and membership for VRE's. Rather than setting up institutional VREs with membership drawn predominantly from within a single institution (albeit with 'guest' access allowed) the alternative – of establishing a VRE defined by disciplinary boundaries, or associated with a specific inter-institutional initiative – was worth exploring. With a new emphasis from research funding agencies on multi-institutional research teams and reuse of data across projects, the establishment
of government funded cross-institutional networks and programmes (such as the SEED/SHEFC-funded Applied Education Research Scheme in Scotland, and the development of GRID technologies and discipline-specific 'Web 2.0' applications, this question was timely and relevant to both the CARET team and TLRP, the latter being concerned to explore the 'added value' to research activity provided by programme support – including electronic tools.

**Evaluation of Sakai**
The Sakai project appeared to offer considerable flexibility in deployment and, as a community development project involving a range of research-active partners, it was a candidate for adoption for both TLRP (with its broader sector-wide ambitions) and the University of Cambridge. Prior to this project, however, most development and evaluation work had concentrated on use of Sakai in teaching-intensive activities; and evaluation of its potential as a Virtual Research Environment was necessary. At the same time, there was interest in the JISC/E-Science/E-Social Science communities in evaluating Sakai as a potential development platform.

**Research Design and Methods**
The research design of this project* involved the compilation of a series of chronological case studies (Yin, 2003; 125-127) of projects of different size and scope, which themselves employed a range of research approaches including case studies, surveys, interviews, interventions and action research. Case study was agreed (within the project, and in consultation with the steering group) to be the most appropriate research approach given the diverse nature of the projects. Alternatives, such as establishing a quasi-experimental intervention were rejected; at the beginning of the project it was not clear what factors would effect patterns of VRE use, or how any variation might be operationalised. This lack of clarity about the nature of relationships between potential dependent and independent variables would have made it difficult to identify what should be ‘controlled’ or what the nature of any intervention should be. In fact, we were unsure of the extent to which there would be any correlation between collaborative practices and use of what purported to be collaborative technologies.

These case studies involved semi-structured interviews, field observations, content analysis and use of routine data such as server logs to illuminate trends in use. This multi-method approach allowed not only triangulation between data sets, but also allowed presentation of selected data

* Since there are multiple 'projects' involved, references to 'the project' refers to the JISC VRE project itself; 'partner projects' are the TLRP projects participating in VRE use; and 'the programme' is the TLRP as a whole.
and interpretations to participants in focused 'co-interpretation' activities, in which they assisted in interpretation and contextualisation of the data collected. Elements of the case study approach included:

**Initial Data Collection: Documentary Analysis**
The TLRP directors' team provided a range of relevant documents including project proposals and annual reports submitted by those TLRP projects that had been running for over a year. Partner projects also provided key documents: proposals, plans and timetables of research activity against which background the project would take place. Also of interest were documents that suggested particular patterns of collaboration and potential VRE use. These documents were also assessed in order to make a general assessment of the level of electronic tool use. We also reviewed the use of the dotLRN online environment in order to obtain an overview of patterns of collaboration and the amount of use being made by more established projects, and reviewed the content of public websites established by some of the projects.

**Initial Data Collection: Email Questionnaire**
An initial email was sent to project directors, providing details of the project, establishing the levels of support and data collection involved and asking them for an initial assessment of the role that that VRE might play in project activities and setting out the main questions which would be addressed in the subsequent interviews. Responses to this email questionnaire allowed the setting up of basic Sakai worksites, with tools already in place where they had been specifically mentioned.

**Initial Data Collection: Project Director(s) Interview**
The initial interview with project directors was designed to provide data in three areas: the main intended research outcomes of their project; the patterns of collaboration across their project; and the role they thought the VRE would play within their project. The last two of these were seen as different issues; as described above, we made no assumption that ‘offline’ collaboration (team working, meetings or co-authorship) would be a predictor of ‘online’ collaboration using the VRE. In addition, project directors were asked to identify upcoming 'critical incidents' - events, landmarks, beginnings and ends of phases of project activity – at which further data could usefully be gathered and the predictive model derived from the interview tested and refined. They were also asked to identify key project members and users about their use of the VRE.
within the project. These interviews were often combined with a site visit during which members of the research team were given an introductory training in accessing and using the VRE.

Document analysis, email responses and initial interviews with project directors were used to develop a series of user requirements – in some cases related to specific tools and functions of the VRE, and in others to patterns of collaboration which they hoped to support. While in some cases these are in outline form only, subsequent interviews would be designed to revisit and elaborate these requirements. Subsequent interviews and discussions maintained a focus on the key elements introduced in the initial interviews: research outcomes, patterns of collaboration and real and potential applications of the VRE.

**Continuing Data Collection: Site Visits/Informal Discussions**

Once project participants had identified critical incidents, arrangements were made to attend appropriate meetings and other events. These events included formal project 'launch' events; meetings of project steering groups; key points in project designs, such as shifts from data collection to analysis; and the annual conference of the TLRP, held each November. These events and discussions that took place there were documented and field notes collected. In some cases, short review interviews were conducted, revisiting the themes of the initial project director interview.

**Continuing Data Collection: Email and Phone Contact**

Participating projects were provided with phone and email support and were encouraged to share any emerging issues, problems, or emergent patterns of use. Emails were saved and phone requests were documented as part of the developing case record of each project.

**Continuing Data Collection: Content Analysis**

As projects used the VRE, patterns of use were observed and recorded; of particular interest were critical incidents which triggered other online activities; results of 'offline' activities in the online environment; repeated patterns of activity; and evolving roles, responsibilities, procedures and activity flows.

**Continuing Data Collection: Routine Data Collection**

The Sakai VRE generates very detailed 'logs', and the aggregation of the data from these server logs and database tables provides insights into how specific users and groups engaged with the collaborative environment. These largely quantitative data were useful in determining trends in
behaviour, broad patterns and sequences of events, but tell the researcher little about context other than 'who', 'when', and 'from where'. In order to explore further what contributes to these observed patterns, a focused interview protocol was designed in which, following appropriate data reduction, research participants were engaged in a set of ‘sensemaking’ activities in which they provided interpretations of specific incidents and offered rationales for short-term and long-term trends in access, use and online interaction. This instrument was used in conjunction with the final project interviews.

**Final Visits and Interviews**

The research approaches described above were used to build up a progressively more detailed case study of each of the participating projects. This was then used as the basis and focus of a series of interviews and discussion activities with project participants, by which time they would have been using the VRE for up to 18 months. Three specific activities were involved:

i. Grids showing use of Sakai tools were used to explore the specific VRE functions which had been applied in project activities;

ii. Trend data based on the routine data was used, in association with a semi-structured interview protocol, to make sense of long and short-term patterns of VRE use;

iii. Sequences of activity, generated from content analysis, field notes and routine data were used to develop outline ‘activity flow’ models

This series of activities involved as many members of the project teams as possible in order to explore multiple perspectives on use of the VRE.

Initially, we envisaged working with partner projects for 15-18 months, from early 2005 until summer 2006. This aligned well with a set of partner projects which were due to begin work in either January or March 2005 but in the event, our activities deviated from this ideal model as we became aware of variations between the partner projects, and in response to their own timetables and commitments.

**Emerging Roles and Responsibilities within the Project**

What became apparent soon after we began to work with project partners was that the responsibility for developing the VRE within each was project was differently conceived across the projects. In some, the VRE was seen as a means of enabling collaboration across the project team; in others, it was construed as a project management tool for use by the project’s principal investigator; and in others it was seen as primarily being an tool to aid administrative staff in their
management of data and documentation (these patterns are explored further in Laterza, Carmichael and Procter, 2007). As a result, we found ourselves interacting with a range of individuals in different roles within projects, and as projects evolved over time, we were able to observed shifting patterns of responsibility. One important pattern was that, with a few exceptions, it was research administrators and research associates who were in most regular contact with the VRE research team at CARET. Most of the directors, co-directors and other established academic staff who participated were committed to TLRP projects for a small fraction of their time – characteristically 0.1 - 0.3 FTE. When they used the VRE, it was generally for specific tasks, and extended interaction with the CARET team (by phone or online chat) was rare. This meant that the role of project administrators, even where it had been initially described as a management task, evolved over time as they became not only the most expert users of the VRE but also the mediators and brokers of interactions (including emerging requirements and questions about VRE capabilities) with the CARET team.

These personal roles were paralleled by a developing role for the VRE itself within the projects. For some users, the VRE was simply a means of fulfilling specific tasks, while for others, particularly the administrators whose roles were developing alongside the projects demands and expectations of what the VRE might offer, it was broader in scope. When participants talked about ‘the VRE’ or ‘Sakai’ this might mean: the separate whole, embedded within a macro-organisational framework; the specifics of the processes established by the group; or a single function offered by the technology. Part technical, part social and part conceptual, the meaning attached to 'the VRE' was discursively constituted, malleable and evolving.

At the same time, the roles played by the research team were also malleable and responsive to the needs of the projects who were using the VRE. As well as being researchers involved in the activities set out above, we also provided training, ‘helpdesk’ style support for participants, and acted as intermediaries between them and the software development team based at CARET, whose job it was to provide services and tools which matched the emerging patterns of use amongst the education research projects. There was never any expectation that what the VRE offered from ‘day one’ would be exactly what the research teams wanted or were ready (and willing) to use. There was, rather, an iterative process in which researchers and developers gradually came better to understand each others’ requirements and capacities.
The development and implementation of the VRE within the TLRP has involved, then, what has been described as ‘co-configuration work’ (see Victor and Boynton, 1998; Ludvigsen, Havnes and Lahn, 2003) with ongoing relationships being ‘brokered’ by researchers with sufficient knowledge of both the world of education research and that of software development to be able to mediate between them. In situations like this, brokerage roles extend beyond simply acting as a conduit between systems; rather, they involve identifying opportunities for collaboration and useful interchange (what Burt (2000; 2005) describes as 'structural holes' in networked organisations); and also (as in Wenger's (1998) view of brokers), the building of shared meanings that have relevance within multiple systems and the communities within which they are embedded. In other words, the role of the broker is both to intervene in the already-established discursive practices of multiple communities and to try and relocate these to a more neutral 'between-systems' space. This involves not simply collecting and reporting the needs, concerns and views of each community, but also legitimising concerns and problematising issues which may hitherto have been seen as insignificant or unproblematic (see Carmichael and Youdell, 2007, for an example of this related to the ethical issues thrown up by the establishment of an online research community).

The Ideal User, the Ideal Technology and the Hacker Ethic

One of the key issues which we, as brokers, had to deal with, was a tendency for participants in the project to couch their discussions in term of 'ideal' types: ideal users and sets of requirements, in the case of technologists, and ideal technologies in the case of potential users. This has echoes of Becker's (1970) notion of the 'ideal client' which has subsequently been reworked in educational contexts by, among others, Gillborn (1990) and Youdell (2006) in their discussions of 'ideal' learners. Although the context is different, what this perspective suggests in the context of technological development is that there are discursively constituted notions of the 'ideal user' of technology (and, for that matter, discursively constituted notions, on the part of users, of the 'ideal technology'). The discourses which contribute to these are centred around the generation of exemplars rather than the development of rich and potentially problematic examples, with the
possibility that these exemplars then become normative and are seen as benchmarks against which personal or group competences or practices may be measured. This was a key issue raised by some of the research users of virtual collaboration environments provided by the TLRP, who were concerned that the technology did not come either to constrain or define research practices and relationships.

There is an risk here of slippage here, on the part of technologists, who may begin talking about ideal users (characteristically expressed in terms of ‘personas’ (see, for example, Pruitt and Grudin, 2003) but in exploring the patterns of interaction of these users may actually come to talk about ideal research processes which will necessarily represent particular ontological and epistemological stances. Attempts to produce generic models of research processes, particularly in naturalistic contexts of much education research may be doomed to failure and may even preclude the engagement of potential participants who cannot see opportunities for technological support of a particular research approach to which they are committed. The attempt by JISC to identify generic elements of a ‘scholarly knowledge cycle’ (Dovey, 2007, based on Lyon, 2003), was greeted with horror and amusement in about equal measure when we presented it to a group of project participants with backgrounds in education research.

What the VRE project provides in this context is a set of accounts which illustrate the range of educational research projects and the associated variation in how collaborative technologies were understood, implemented and developed as they were aligned with broader research designs and issues. These are examples, not of ideal ‘use-cases’, but of real-world situations and of individual and group efforts to to identify, describe (sometimes) respond and find solutions to them. This variety will be further explored in the final paper in this symposium, but for now, this paper will explore one pattern or tendency which emerged through these brokered and iterative relationships.
‘Hacking’ is a term which is usually applied to technologists and particularly computer programmers of a certain disposition. The ‘desperate Perl hacker’ (DPH), for example, is an ‘ideal type’ of the kind which has been described above – looking for a quick solution to one of the multiplicity of practical problems which face web or database programmers as they try to integrate multiple data types, legacy systems and web applications, almost always under pressure of time. The meaning of hacking is contested and involves several apparently contradictory elements – on the one hand it is associated with a ‘quick fix’ to a problem, while at the same time it may represent an elegant or creative solution based on deep understanding of detail or a recognition of the underlying simplicity in an apparently complex problem.

As participants in the project (both researchers and developers) became aware that they were not dealing with ‘ideal types’, rather different patterns of behaviour began to emerge. As participants became aware of the capabilities of the VRE and its tools, and of the capacity of the developer team to respond to their needs, the number of requests for completely new online tools with all of the features of existing proprietary software (Office tools, SPSS, Nudist, Endnote) declined. In their place were questions about ‘how best to’ address some need or problem.

For example, one project wanted to subdivide their online resources area, maintaining one area as private and access-controlled and others as more ‘open-access’ resource banks. At the time, the fine grained control they demanded was not available (this has bee addressed by subsequent upgrades of the VRE). In the short term, however, and in collaboration with the members of the CARET research and developer team, another solution was devised: three separate 'Resources' tools were created, each used for a different type of documents and each with a different 'permissions' regime. This was done by creating two additional worksites (kept 'hidden' from participants) and by linking these worksites to the main worksite of the project. In this way, the separation between documents was made more evident and the three resources tools (appropriately renamed) all appeared as distinct ‘menu’ items.

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1 The characterisation of the DPH is attributed to Michael Leventhal in an online article “XML: Can the Desperate Perl Hacker Do It?” (http://www.xml.com/pub/a/w3j/s3.perl.html) published in October 1997.
2 It should be noted that a solution which is inelegant, increases complexity and will probably cause problems in the future is distinguished as a *kludge.*
What happened here hints at two interesting phenomena which have characterised the way in which VRE use developed. The first concerns the relationship between the VRE project research team and the participants in the partner projects; the VRE project team played an active role in stimulating user engagement and suggesting approaches to VRE development, and the participants called on the VRE project team for advice, training and technical support. Without the input of the VRE team, the users of Sakai would have been unlikely to have been able to devise a satisfactory configuration of their worksites, and might even have abandoned its use. The second concerns the original usage of the technical tools available at the time. Sustained dialogue between researchers, users and developers allowed the discovery of the limits and potentialities of the Sakai platform and (after some thought and 'tinkering') allowed the group collectively to come up with new ideas and configurations that could have not been predicted a priori without contextual experimentation in real life situations. This is a good example of what Ciborra (2002) describes in his more broadly defined notion of 'hacking'. He argues that the original usage of the available technology beyond the planned intentions of the initial design is a fundamental reality of the life of all information systems.

Complex technologies will stand little chances of success if users are not allowed to play with its features and experiment to the point of finding new usages that could have not been anticipated by the developers. 'Hacking' by users is an essential reality of successful IT infrastructural development, and while developers cannot anticipate all possible specific applications, they should anticipate 'hacking'. This means that they should be as open-minded as possible in their own software design, programming tools and features to allow for the highest level of flexibility. The VRE is a good example of this: users can determine the number of worksites and which tools to insert in their own configuration; they also have a good degree of flexibility in configuring the individual tools, just as they can establish social norms for conduct within the worksite.

To allow for a meaningful interaction between developers and users, numerous and continuous acts of brokerage and 'translation' back and forth between the epistemic domain of developers and that of users need to be carried out. In some cases this may involve challenging beliefs that to one
group or the other seem self-evidently true, or problematising what seem self-evidently beneficial. This issue has been raised in the context of Virtual Learning Environments more generally; Conole and Dyke (2004) pointing out that all of the major 'affordances' of online working are also potentially barrier to adoption. An excellent example with which we had to engage in the course of the VRE project involved the installation of a 'Site Statistics' tool which allowed maintainers to review virtually every aspect of online interaction in a specific VRE worksite. For those partner projects which were concerned to demonstrate engagement through the VRE, this was a useful tool; but for those who had established research protocols with participants in online discussions about controversial issues and who had been assured that they were under no pressure to contribute and that their confidentiality was guaranteed, even the installation of the tool in a worksite presented problems. In the same way, the facility (in the Sakai VRE and also in many other online environments) to have 'who's online now' displayed may for some users be extremely valuable, while for others may be a significant disincentive to participation.

The successful development and implementation of multi-purpose Virtual Environments such as Sakai will depend on developing deep understanding of different educational contexts, on effective mediation between technologists, researchers and practitioners, and on the continued recognition that, while we do not know how people will 'hack' things, we can be assured that they will hack them.
References


