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## ► To cite this version:

Maria Zenios, Chris Jones, Peter Goodyear, Mireia Asensio. Designing to facilitate learning through networked technologies: factors influencing the implementation of digital resources in higher education. ALT-C 2004 Conference: Blue Skies and Pragmatism: Learning technologies for the next decade, 11th International Conference of the Association for Learning Technology (ALT), September 14-16, 2004., 2004, Exeter, United Kingdom. 11 p. hal-00190224

HAL Id: hal-00190224

<https://telearn.archives-ouvertes.fr/hal-00190224>

Submitted on 23 Nov 2007

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**Designing to facilitate learning through networked technologies: factors influencing the implementation of digital resources in higher education**

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# **Designing to facilitate learning through networked technologies: factors influencing the implementation of digital resources in higher education**

## **Abstract**

*Recent advances in computers and telecommunications have allowed networked learning to play a significant role to play across the complete spectrum of higher education teaching. One of the most significant UK government initiatives to date has been the development the Information Environment (IE) originally called as the Distributed National Electronic Resource (DNER), which is aiming to create a managed environment for accessing quality assured information resources on the Internet (IE, 2004).*

*This paper draws on our formative evaluation of the IE and the investigation of the take up of digital resources produced by a number of projects selected for funding under JISC circular 5/99. Although we identified examples of good practice in using the IE to support learning and teaching and instances where digital resources were successful in addressing certain needs for the learners the benefits were less than anticipated. The digital resources produced by the projects seem to hold a potential to support teaching in higher education, however, the actual impact they had on learning was found to be less than anticipated. The findings suggest that the application and implementation of networked technologies is partly determined by the social context in which it operates. Finally, the paper advocates the need for action to influence educational practice and engage related parties in a genuine way in order to realise the transforming potential of networked learning. By exploring the implementation of information digital resources in teaching and learning under the framework of actor network theory, this paper makes a contribution to the development of theory and practice in the area of networked learning.*

## **Keywords**

Networked learning, pedagogic design, evaluation, actor network theory.

## **Introduction**

In the Information Age technology is the indispensable tool for the development of networking as a dynamic form of organisation of human activity (Castells, 1998). This points to the need to exploit how technological affordances can support authentic learning. Within that context, networked learning has emerged and it is defined as learning in which information technology is used to promote different kinds of connections among learners, tutors, resources and communities (Jones and Steeples, 2002).

Universities throughout the UK are exploring new approaches to teaching and learning through information resources by establishing learning technology initiatives. The

promotion of networked technologies has been a vision of national policy initiatives. The UK has embarked on technological developments with government support. JISC (Joint Information Systems Committee) has invested on an online Information Environment (IE), which will provide access to a range of scholarly resources and educational materials, specifically designed to meet the challenges that universities and colleges face in providing secure and seamless access to quality digital information resources to support teaching, learning and research (IE 2004). A key challenge has been to achieve a managed and coherent IE that would be compatible with related developments within institutions and known amongst corresponding user communities which would take up and use the digital resources provided in teaching and learning.

This paper discusses the conclusions of an evaluative study on pedagogical uses of the IE, in particular the implementation of JISC 5/99 project outputs and digital resources in higher education. The theoretical framework adopted for this study on networked learning is based on ideas of social theories of learning and community and network actor theories in particular.

Actor network theory looks at learning, knowledge and networks. Latour (1992) recognized that semiotically both human actors and nonhuman participants i.e. artifacts were equally actants, they were defined by how they acted and were acted on in the networks of practices. Actors, all of which have interests, try to convince other actors so as to create an alignment of the other actors' interests with their own interests. When this persuasive process becomes effective, it results in the creation of an actor-network. Fox (2002), suggests that in regard to learning through electronic resources we must think of the learner as an integral part of a network, an actant and not as an empty container waiting to be filled.

Actor network theory can be seen as a systematic way to bring out the infrastructure that is usually left out in accounts of technological achievements. It is pertinent to this study because it links together technical and non-technical elements of a network by placing equal emphasis upon the technological artefacts and the social meanings. It shows how digital resources and social groups may interact on each other.

### **Research Methods**

The case studies were conducted using a mixture of methods. In all cases there was a documentary analysis of the project plans and written products. In each case a project summary was drawn up in a common format reporting a digest of this literature review and some additional items considered to be of interest by the evaluation team. Table 1 provides a list of the projects studied with a brief description of their purposes including their aims and objectives (N.B. The names of the projects are not conveyed and specific contextual information is omitted to ensure confidentiality).

Project	Purposes (Aims and Objectives)
Project 1	Improve access to objects in art and archaeology collections by creating digital representations of them. Such objects are often too widely dispersed or too fragile to allow easy or intense scrutiny. Develop teaching materials which help teachers integrate use of these resources into their teaching.
Project 2	Improve use in learning and teaching situations of the collection of specific data by improving access to the data (eg through a portal) and by providing additional learning & teaching materials; awareness raising etc. Special mention made of problem-based learning and student project work.
Project 3	Ready integration of moving imagery into educational applications. Project includes work on educational design and evaluation of educational effectiveness
Project 4	Using VRML and other technologies to make objects and archives of Museum X accessible to remote learners and teachers.
Project 5	Help students of a specific discipline develop their information skills and make better use of IE within VLEs.
Project 6	Create database of 3500 digitised images of materials etc in a specific University museum & accompanying teaching materials in three departments' courses.
Project 7	Aim: to assist in integrating the growing array of groups and projects across the HE and FE sectors producing materials for supporting academic development in the use of C&IT in learning and teaching.
Project 8	Allow students of a minority language better access to the spoken language; enrich the range of teaching material available to them; provide them with better opportunities for peer-interaction; within context of a 3-university virtual department.

Table 1: Projects selected as case studies

The additional items included consideration of the nature of the project outputs in relation to three dimensions:

- The degree of mediation required
- The degree of independence of other resources
- The degree to which pedagogy was implicit within the outputs (see Table 2)

Project 1	Teaching materials to integrate art resources & objects	Not much mediation required Independent from other resources Pedagogy implicit
Project 2	Single point of access to specific data & associated learning materials	Mediation required Independent from other resources Pedagogy implicit
Project 3	Examples of uses of a specific technological tool, guidelines on uses	Low Mediation required Independent from other resources Pedagogy implicit
Project 4	Database/ collection of 'X' Museum objects	Mediation required Independent from other resources Pedagogy not implicit
Project 5	Learning object database	Mediation required Dependent on other resources Pedagogy implicit
Project 6	Distributed image/database collection	Mediation required Independent from other resources Pedagogy implicit
Project 7	Portal exchange for a specific professional user group	No mediation required Dependent on other resources No pedagogy implicit
Project 8	'X' language learning resources	No mediation required Independent from other resources Pedagogy implicit

Table 2: Taxonomy

Projects were also assessed in relation to the challenges that they had faced, for example in recruiting staff or in relation to developments between partner groups. This also included a consideration of the unintended outcomes that resulted from some projects.

In some cases project activities were visited such as workshops and other dissemination events. A mixture of telephone and email maintained contacts with project teams themselves and in some cases visits were made to the project teams. Project outputs - defined as identified deliverables - were examined remotely when this was possible and in some cases users of project outputs were contacted and visited or they provided written comments to the evaluators.

Although the project team had discussed project users with all ten projects studied there were only a few opportunities to get in touch with actual users in real settings. We

looked at actual users engaged immediately with resources produced by six out of ten projects.

It is useful to stress that our study involved a programme wide evaluation and we made no attempt to evaluate individual projects. Our engagement with projects was intended to be largely formative in character and the remarks here should not be taken to be definitive or summative statements about a project or its worth.

## **Discussion**

Projects produced learning materials and resources delivered in different forms: reports, guidelines, discovery tools, software websites and workshops. In some occasions these resources were simply being made available to students and teachers based on the assumption that their use would lead to definite educational outcomes, without having a clear picture of the user and of how they would interact with the resources. However, case studies or problem scenario studies conducted by the projects during the design process often helped them to configure the user and to envisage certain user needs and characteristics. This information about the user enabled projects to place emphasis on developing strategies for transferring the knowledge and skills learnt especially in regard to the implementation of the information resources on learning and teaching. Most projects provided valuable resources, which promoted active learning as demonstrated in the case of Project 4 below:

*'I learnt more about critiquing resources'.*

(student user)

*'One of my aims is to make them think, to encourage them to ask questions, to see things from their own perspective... to learn how to think critically about materials [...] With [Project 4 resource] I am introducing them to materials I might otherwise not be able to [...] Students are interacting with the material on their own, with each other and with me at the same time'.*

(teacher user)

From the projects we followed more closely, some provided supportive material to the users conceived of as learners and/or teachers in the form of guidelines, course-specific teaching tools, tutorials and learning paths. The following section discusses a number of factors who were found to influence the implementation of digital information resources produced by the projects in H.E.

## **Factors influencing the implementation of digital resources in H.E.**

*Factor 1: The development of specific and targeted relationships between projects and some well-defined segments of their target user group*

A useful way to set the foundations for a relationship with a user group has been the organisation of workshops. Six out of the eight projects studies used workshops as a means of connecting to a user group and as a device to show the project's activity. This

enabled to present the resource and to exchange knowledge and new understandings among interested parties. The following example describes the ways in which Project 5 (see Table 1) managed to forge strong links with user communities:

#### Example 1: Project 5

The project has been highly visible and has published a wide range of materials on the project web site. The project has had an engagement with very specific audiences, particular courses in specified departments in a selection of institutions. The aim of the project to produce a transferable model has informed project activity at all stages and though the home institution was the primary site for development the project has sought to engage other potential users from an early stage. One of the more impressive features of the project is the buy-in it has achieved from partner sites. The following quote is taken from our interviews with staff using the resource:

*'We have found the software very easy to use and customise and we feel it has saved us a lot of time in preparation as well as giving the students a more interesting introduction to our resources. Feedback from them so far has been very positive...'*

(user teacher)

We believe one of the key features in the success of this project has been the ability to have a general aim that has been embodied in a set of specific actions throughout the life of the project. The project has been clear about its audience and has maintained a strong relationship with key personnel who have been able to embed the project in other locations away from the main project. Its ability to target locations and personnel we would argue is a key to the apparent success of this project.

#### Example 2: Project 7 (see Table 1)

Difficulties in engaging a user community have been experienced by Project 7 whose output was itself dependant upon a user group perceiving a benefit from engagement with the project as it had to deliver a web based portal and engage a user community who would populate the portal with resources. The evaluation team attended project workshops at which two features of the user group became apparent. At one of the workshops the user group displayed a degree of disunity. Some of the attendees at the workshop clearly wanted an action oriented portal providing hints and tips for busy practitioners. Another group expressed sharp disagreement suggesting the portal had to provide the basic results from which a research based practice could develop. The user group for Project 7 was not a mature community and it seemed to have very different expressed needs. The project team was not in a position to moderate between these divergent views or provide a solution that would satisfy both.

Although Project 7 developed a useful web-based portal, the academic community made little use of it. The main reasons reported by the project were the difficulties they faced in bringing the community of learning technologists together in the time available. The project was intended to go through three phases a)needs analysis, b)trial stage and c)mass use. At the third stage the project team simply ran out of time. It is



still in question whether the user group if given more time would have populated the portal and filled it with resources or created a forum for sharing and collaborating. It begs the question of whether the user group was sufficiently well understood by the project team. Project 7 shows problems more starkly than other projects also face. The user group identified by the project proved to be more complex and less generous than the project team anticipated. The project found itself in complex loops in which competing demands worked to undermine coherent development of the project into outputs that had a sustainable benefit to the intended user group.

*Factor 2: The development of definite contacts outside of the project area for targeted projects with the aim of transferring and generalising project outputs*

We have defined as targeted projects those with a narrow or highly specific focus and a clear and delimited target user group. Examples of these would be projects such as Projects 1, 4 and 6 (see Table 1) that aim to provide access to particular collections with a definite audience for those collections in mind.

Example 1: Project 6

We would point towards Project 6 as a good example of both a self-conscious willingness on the part of the project to widen the scope of the project to others and of the problems that can arise with project that has a very specific location and target group of users. Active management of such projects might be necessary to ensure that the lessons learned are made available through JISC networks to a wider audience.

*Factor 3: Projects with broad or generic aims should be encouraged to work with smaller and well specified target groups during development rather than relying on immediate connection to a wider community*

The definition of generic projects is those projects that have general or generic target audience. The distinction between these projects and targeted projects is one of degree and many projects displayed elements of both a targeted and a generic audience. An example of this would be the Project 5 that was focused on particular institutions and definite courses but aimed to address the generic issue of information literacy. Examples of other generic projects are Projects 2, 3 and 7.

Project 2 provides a good example of how targeting can provide a useful focus assisting projects face up to the usual delays faced in recruiting personnel.

“ In the previous biannual report we discussed the issue of piloting of materials being a problem for some sites. This continues to be the case, and regardless of our outreach work to the community we have received few offers to pilot the materials. However, this issue was also addressed at the all project meeting in June, with the result that *all partners responsible for piloting materials have been working on recruiting two or three sites with whom they can work closely over the next academic semester* in order to pilot materials. The feedback from this work will be incorporated into the materials, which will subsequently be promoted to a wider teaching audience.” (Project 2 Report to JISC covering 2/02 – 7/02, Italics added)

This example illustrates the problems that can face projects that actively try and engage with potential users. The evaluation team attended Project 2 workshops and in the early stages workshops contained a wide range of participants, some of whom were unlikely to take-up project outputs, for example retired academic staff. The use by the project of a series of workshops with potential student users was highly productive for the project team in drawing attention to issues that might be of concern. The project showed persistence over time with the aim of actively engaging its potential user community. By doing this, the project gained a more accurate view of who was likely to use its products and the conditions and contexts of use. We think that JISC may have a significant role in encouraging projects to develop early links with potential user groups, especially students and academic staff.

In general we would recommend that projects think of who exactly the user might be i.e. not teachers in general but teachers as represented by a specific sub-set with whom the project can develop a continuing relationship.

#### *Factor 4: Timing of user testing and evaluation of products*

Experience with all eight projects shows that user testing needs to be built in earlier into project life spans so that teams can identify as near to the beginning of the project as possible areas that hinder learners from gaining maximum benefit from using the resources. Similarly time should be given for evaluation of products and resources well before project end dates and these should be planned in appropriate time, taking into account the rhythm of the academic year (e.g. making sure interventions are before the end of terms/ not during exam periods).

The following reasons were reported for facing difficulties in getting users involved and test their materials and outputs: a)because this had not been a formal part of their studies, b)the focus of the project was highly specific therefore the number of potential users was very limited and because targeted relationships had not been established between the project and lecturers/students in the first place.

#### *Factor 5: Students' perceptions of technology*

Familiarity and previous experience with the use of computers and networked had been considered as feature of the user from most of the projects. In the case of Project 2 the student user of the resource had been clearly visualised as being familiar if not confident with networked technologies and capable of working on their own. In contrast, Project 5 aimed to help students develop their information skills and took students through a guided set of materials in a way that technological knowledge was not a pre-requirement. A third project (Project 3, see Table 1) whose products were directed to academics, mainly lecturers and tutors had a clear view of the user as being a teacher of any subject area with an interest in technologies but not necessarily equipped with the technical skills needed in such developments or informed by the pedagogies entailed in implementing related digital resources in learning and teaching.

Our evaluation with two other projects (Projects 4 and 6) showed that a limited number of their student user group encountered some technical difficulties and whilst held non-positive perceptions in terms of using computers in general. A student user mentioned:

*'I could use the resource from home but I needed to use my hard-drive on campus. I wrote my essay at home in word, I accessed the resource to identify the pictures and printed them out, I like working from printed copies. I did my work from Word and then transfer it to Dreamwaver, but it lost some of the formatting...I became so frustrated that I nearly didn't do the course because of that'.*

This points to the need to take account of those students who still consider the use of digital resources and computers to be incompatible with their subject areas. It should not be taken for granted that students will be enthusiastic about new initiatives without being given a particular impetus.

## **Conclusion**

The paper suggests a range of factors that influence how digital resources can be used in learning and teaching higher education. These relate to a) the development of targeted relationships and contacts between the digital information resource designers and the user community group, b) engagement of the target user group during the developmental stages of the resource and c) a rich understanding of the characteristics of the user on behalf of the information resource designers. All these influencing factors are related to how the digital resources can be implemented in learning and teaching in higher education and should be considered together. Seen under the actor network perspective the designed artefacts establish parameters for the users' actions and thus they should not be developed independently from the targeted user in order to facilitate better and more widespread use in teaching and learning.

## **Acknowledgements**

We would like to thank all the projects described above as well as lecturers and students participated in the case studies and sharing their views with us. This paper is based on an evaluation study funded by JISC and we are grateful for the financial support we received. It should not be assumed views discussed in this paper are shared by JISC staff or by other members of the EDNER team.

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