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# **The Virtual Design Studio: developing new tools for undertaking design research**

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**Key words:** *Virtual design studio, generative systems, networked technologies, digital libraries and constructivist theory and design process.*

## **Abstract**

The emergence of new networked technologies such as virtual learning environments (VLE's) and digital libraries are providing opportunities for the development of new virtual tools to assist the design researcher in exploring ideas with the aid of visualising and mapping tools and to provide interfaces that support interdisciplinary collaboration between design teams.

In 1998 a research project was initiated to evaluate the potential of computer assisted learning within Art and Design. This resulted in the development of a virtual learning environment designed to support Art and Design students and staff ([www.studio-space.net](http://www.studio-space.net)). This paper describes the design process used to develop this VLE and the underlying principles based on a constructivist approach to experiential learning.

The on-going research uses the metaphor of the 'design studio' to explore a range of technologies that provide generative tools for the representation of design practice and related research, including the development and evaluation of an online Personal Development Planning tool (PDP) and other information management systems. The paper explores some of the ways in which tools such as; information retrieval applications, white-boards, visual mapping and digital archives can be combined to provide a virtual online design research studio. A further extension to the metaphor provides opportunities for developing new facilities, for example the portfolio, drawing board, bookcase, model-making area.

The virtual design studio has two potential uses: first, to provide a tool box for the design researcher/educator to undertake collaborative design practice using CAD/CAM applications; second, to provide systems that help to externalise design methodologies, thus making it possible to gain an insight into the design process itself. This latter outcome can be achieved through the use of meta data (such as author, date/time created, version number – i.e. design iteration, note pad) and the representation of critical decision paths and reflection points.

## **Introduction**

Higher Education over the past ten years has seen a dramatic increase in the introduction of Intranets and Extranets designed to support teaching and learning. Many universities have invested in products such as Web TC or Blackboard, which provide facilities for publishing teaching materials and communication tools such as email and threaded discussion tools. As systems have developed the possibility of linking other information management systems designed for course administration and content delivery has grown. The term Virtual Learning Environment (VLE) has been coined to describe such systems. A VLE refers to learning management software that provides computer mediated communications (email, bulletin boards, news groups, etc.) and online methods of course delivery. The Joint Information Systems Committee (JISC) in the United Kingdom has defined a VLE as a system that provides access to 'online interactions of various kinds which take place between learners and tutors' – ref: <http://jisc.ac.uk/mle/>. Such systems are commonly accessed using a standard web browser and do not require a specific piece of software or client application in order to access them.

Currently a large number of VLE's exist or are in development globally with a trend towards integration with centrally maintained information sources, the emphasis being on the development of systems to support course and institutional administration. One of the JISC Technology Application Programme report states that the overall aim of introducing a Virtual Learning Environment is to reduce the administrative load on tutors in order to allow them to manage their workload more effectively so that they can give more time to individual students. In addition it is to provide opportunities to improve the quality and variety of teaching and learning, enhancing current methods (Britain, S. Liber, O. JTAP report 1999). The principle advantage of linking up autonomous (stand alone) VLE's with centrally managed data sources is to avoid duplication and improve the accuracy of the information being used. An example would be the use of matriculation records used to set up Intranet/email accounts for students automatically, saving time and effort. If the information is inaccurate it will be brought to the attention of the appropriate department by the student or member of staff affected. This provides an effective error checking mechanism.

This paper describes research that has been undertaken to develop a VLE suitable for use in an Art and Design environment. It describes the design process used to develop the system and speculates on how a combination of available web based tools, and new tools yet to be developed, can be brought together to provide an environment specifically designed to support collaborative working and design research.

Web developer software is becoming more accessible helping to accelerate the proliferation in VLE developments. This is generally a good thing, despite the inevitable re-invention of the wheel syndrome, since every VLE or MLE developed and used provides new solutions, some of which may be adopted by later generations if they are found to be useful.

## **Background**

In 1998 a prototype VLE called 'StudioSpace' ([www.studiospace.net](http://www.studiospace.net)) was developed using a relational database and web publishing software. This early prototype consisted of a module descriptor database, student records, a resources database, a self-appraisal and assessment database and incorporated 'FirstClass' (<http://www.centrinity.com>) which provided the communication tools.

In 2000 further funding was obtained to develop the initial prototype to allow it to be integrated with other University data sources. This revised system is currently called GraysNet. It provides access to student information, course information, a project authoring tool, a resources database, course administration tools and discussion forum.

Systems claiming to be VLEs generally provide some elements of collaboration and networked community. However, the field is evolving rapidly with the development of specific user interfaces and 'cognitive tools'. Recent environments combine a knowledge base with customised user interfaces - allowing users to interact with and to construct or create new knowledge, processes and practices.

Some of these environments are built on a model of passive collaboration using the technology as a means of cooperative sharing of information and resources. Such systems endeavour to:

- Make information more accessible and transparent (e.g. using the technology for dissemination, auditing, quality assurance etc)
- Structure the information and resources around users' needs (e.g. using the technology to target or individualise information and resource access, development of 'intelligent agents' or search engines)
- Provide interfaces for 'posting' information or resources to a database

In more sophisticated developments, these may add value to distributed systems within or across organisations as Managed Learning Environments (MLEs) to integrate the management of processes more effectively and transparently.

The more recent models reflect the active construction of meaning by social interaction. This constructivist approach assumes that knowledge is created and recreated through dialogue and shared experience. In this type of environment the exchange, mapping, modification and creative extension of this is an 'emergent' process requiring learner to learner and/or learners(s) to tutor(s) cooperation and dialogue in shared spaces and a range of approaches. In this model the tutor is acting as facilitator and moderator.

These environments are more closely associated with active learning. Reviews of these approaches sometimes refer to Pask's conversation theory and Vygotsky's model of 'assisted learning' (1980), in addition to constructivist theory.

Arguably the innovations in the use of technology to support these 'soft processes', (knowledge-building, knowledge representation and knowledge management), have been most rapidly developed in commercial and military contexts where the value of effective virtual collaboration impacts directly on the speed and effectiveness of organisational performance. The 'generative paradigm' – refers to the construction, capture and re-use of transferable knowledge and resources.

The system both generates and captures knowledge assets within networked communities whether 'communities of practice', company intranets or project teams. Features of such systems include:

- Interfaces customised to specific user needs
- Collaborative spaces (textual and visual - e.g. whiteboards, and synchronous and asynchronous tools) that facilitate the rapid generation of new concepts or applications from shared practice or experience.
- Systems or tools to capture and share both the processes and the products of creative activity
- Systems and tools which can achieve this with a range of visual media, and without specialist training for the users
- Scalability and inter-operability to adapt to new technologies and increases in scale of use

A growing number of networked communities depend on the use of shared applications for their collaboration, for example designers located globally, operating in different time zones while working together on a single project. This approach goes beyond providing shared spaces for the 'knowledge building community'. It harnesses the power of networked technology to:

- Individualise access to knowledge and resources around user's needs (i.e. it is user-centric not content-centric)
- Allows the immediate capture, authoring and re-use of new knowledge and resources via the user's desktop.
- Provides a framework for organisational processes (enhancing access, transparency, currency)
- Provide tools for 'soft' processes such as quality assurance and innovation

### **Underlying principles**

It is generally accepted that gaining knowledge and understanding that can be successfully applied in context requires active participation by the

learner and this is unlikely to be acquired passively. Knowledge is acquired through experience or experiential activities. The learner is active and seeking to make sense of the world. This concept is referred to as Constructivism, which originated in 20<sup>th</sup> century through the work of Piaget, Bruner and Vygotsky in the field of psychology and philosophy. Dalgarno provides a more in-depth explanation of constructivism and its influence on the development of Computer Assisted Learning.

A learning environment based on the constructivist approach is designed to facilitate project-based and student centred learning. It also implies that learning is based on the learner undertaking tasks that contribute to the knowledge base, hence the term 'knowledge building communities'; for example, there is rarely only one solution to the given task or problem.

Virtual Learning Environments that apply a Constructivist model to learning have been given the acronym REALs 'Rich Environments for Active Learning'. REALs are VLEs that attempt to engage learners in 'dynamic, authentic learning activities that increase their control and responsibility over their learning processes while they learn problem solving and collaborative skills' (Grabinger and Dunlap 1995).

## **The Design Process**

**Ian can you look at this section in particular and make amendments or add etc**

To design a new VLE system, which would achieve the maximum level of adoption and acceptance by the identified stakeholders – namely students, tutors and education managers - it was necessary to apply an appropriate design method and structured approach from the outset of the project.

It was felt essential that a user-centric design approach be used and in this case the end users identified were students studying both on campus and at a distance, members of academic staff, researchers and staff from a range of support departments.

The research and development process consisted of three main elements:

- A critical evaluation of existing systems and tools
- A wide consultation with stakeholders
- An iterative development of prototypes

This consultation was carried out using questionnaires and facilitated brainstorming events. The resulting mass of data was subsequently analysed and mapped using a software application called 'Inspiration' (<http://www.inspiration.com>). This mind mapping software provided an effective method of visualising the design process and, as a result, the design methods and tools used in developing web-based systems have also evolved and become more effective.

After considerable iterations a navigation structure was achieved. This provides customised menus based on whether the user is a student, tutor or an administrator. It also became clear that these three groups had very different perspectives and requirements.

One of the aims in redesigning the VLE interface was to try and establish an intuitive navigation structure. This has been refined using a cognitive walk through technique in which a specific task is identified after which all the actions required to undertake that task are listed and four questions are then asked of each action. These are:

- Will users be trying to produce whatever effect the action has?
- Will users see the control (button, menu, switch etc) for the action?
- Once users find the control, will they recognise that it produces the effect they want?
- After the action is taken, will users understand the feedback they get, so they can go on to the next action with confidence?

This type of exercise reveals weaknesses in the design to be remedied.

### **The Design Studio metaphor**

#### **Carole can you look at this section and make improvements**

Developing an online environment using the design studio metaphor provides a useful starting point for considering how to develop a VLE which aims to support collaborative research.

Predominately VLEs are designed around the needs of teaching staff and undergraduate students. It is possible however to consider how such systems could be extended to support post-graduate and research needs. Different tools may be needed at each stage in the research process.

Problem identification and contextualisation require sophisticated search engines to find related published work and structures for capturing and critically evaluating the resulting information. Information retrieval applications linked to a bibliographic database for examples. Tools to help with developing research proposals might include proformas that help to structure the proposal and provide information on possible resources. For example, access to information on possible research methods and where to find further information.

Similarly the evaluation and analysis stages require access to possible methods with examples. Tools such as templates for multimedia presentation and communication of the research can also be included.

Using the studio/practice metaphor it is possible to speculate further on what the VLE for design research might consist of.

### **Developing a specification for the new Virtual Design Studio**

## Stewart Can you have a look at this section and make amendments or additions

An essential part of the design research process is the recording of practice. The incorporation of a white board tool into the VLE can facilitate collaboration between practitioners. It can also provide a history of a designs development. Developing image databases that allow the information to be presented in different configurations makes it is possible to map a critical decision path. This type of information could provide valuable research data whilst also making it possible to begin to externalise design practice.

The inclusion of digital library tools (look in JISC bid)

### Conclusions

A VLE for use in Art and Design must complement the pedagogical approach as used within the discipline. An approach to learning that includes experiential, problem based, project based, student centred and team based learning.

Web based tools such as generative knowledge bases, discussion tools, white boards, digital archives/libraries can provide valuable resources for students, academics and researchers working in design. Using such systems to help document and disseminate design research provides opportunities for externalising the design process.

Features The graysnet VLE ??????????????

The resources database developed as part of the VLE allows content to be added to the database online and for users of the resources to rate the value of the resource. This rating facility works in a similar way to commercial websites, for example the Amazon.com book review system. This feature begins to provide a mechanism for verifying the quality or usefulness of resources over time.

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