PATTERNS: USING PROVEN EXPERIENCE TO DEVELOP ONLINE LEARNING

Jones, D., Stewart, S. and Power, L.

Interactive Multimedia
Central Queensland University

Email: L.power@cqu.edu.au

Abstract

The development of online teaching and learning requires a complex combination of skills and experience from a variety of professional fields. There are a number of issues, at both an individual and organisational level, associated with the existing development of online teaching and learning materials. These issues are contributing factors to why many current examples of online teaching and learning fail to meet the early expectations of the medium (Mioduser, Nachmias, Oren & Lahav, 1999). We are attempting to address several of these issues at Central Queensland University using 'patterns'. A pattern is 'a generic approach to solving a particular problem that can be tailored to specific cases. Properly used, they can save time and improve quality (Fernandez 1998).' Our intention is to use 'patterns' to promote appropriation, evolution, adoption and staff development within the organisation and thereby increase the likelihood that applications of online teaching and learning will meet early expectations of the medium.

Introduction

The initial part of this paper discusses some of the major issues related to the development of online learning from both an organisational and individual lecturer/practitioner perspective. The paper then presents a short history of patterns, argues their usefulness in the educational online environment and describes how we are using patterns to address particular issues at Central Queensland University (CQU). We will include examples of how the development and use of patterns is aiding in staff development, collaboration, adoption and appropriation of online teaching and learning. In addition, the paper identifies the issues and additional benefits of this generic bottom-up problem-solving technique.

Issues with development of online learning

The development of online teaching and learning is not a quick and simple process (McCormack and Jones, 1997 pp17). Surveys of websites for teaching and learning (LaRose &Whitten, 1999; Mioduser, Nachmias, Oren & Lahav, 1999) show that the majority of sites do not meet some of the early expectations of the medium. In particular, one survey by Mioduser, Nachmias, Oren & Lahav (1999) shows conclusively that most current educational websites are not making use of the pedagogical approaches favoured by educators and researchers. There are many reasons why this is the case. We suggest that issues associated with the current approaches to developing, implementing and supporting online teaching and learning are contributing factors.

Practitioner related issues

The practitioner

The 'practitioner' in online learning can be a student, academic, instructional designer, graphic designer, manager, administrator or any other individual who in

some way contributes to the process of developing online teaching and learning materials. There are a number of issues which directly influence these individuals or have their origins in the personal characteristics, traits and needs of the practitioner.

The innovator / primary academic practitioner gap

The innovators in online learning are those people responsible for the development of the hundreds, if not thousands, of good ideas for online teaching and learning which appear in the literature each year. Apparently, few if any of these ideas find widespread use within their home institution and even less are adopted by other institutions. The people behind these teaching and learning innovations are either 'lone rangers' or members of centers for the support of teaching and learning. Lone rangers are usually individual teachers who are energetic, early adopters of innovations and motivated by a desire to improve the accessibility and quality of their teaching (Taylor 1998). Centers for the support of teaching and learning are now apparent at many Universities and are responsible for supporting and encouraging teaching staff to adopt innovative approaches to teaching and learning.

There is a gap between the innovators and primary practitioners, especially the academic/teaching practitioner. Innovators are regular readers of educational and educational technology literature and are more likely to be aware of alternative teaching approaches. They place a significant value on educational research and theory. There is wide recognition that primary practitioners do not place a high value on educational research (Reeves, 1999).

Academic practitioners at research universities do not maintain a specialised knowledge of teaching and learning, the emphasis for professional development is placed on their respective discipline areas (Anderson, 1999). To exemplify this phenomenon Anderson (1999) reviewed the library holdings at the University of Alberta, Canada. He found that in the area of engineering the library held 207 periodical publications under chemical engineering (including 24 titles under 'low-temperature engineering'), but had no subscriptions for 'engineering education' periodicals (the last two were cancelled in 1991).

The innovator/primary practitioner gap means that practitioners are unlikely to know about potential innovations let alone how to implement them, and are unlikely to be interested in adopting innovations being advanced by the innovators.

The field gap

The variety of expertise required to realise a successful online learning project will often include computing professionals, graphic designers, instructional designers, teachers/lecturers and administrators. Many of these individual participants have limited understanding or appreciation of the other disparate fields. This lack of appreciation and understanding reduces the effectiveness of many teams attempting to develop online teaching and learning materials.

Online learning is new

Many, if not most, applications of online learning continue to reuse development processes and teaching strategies from traditional forms of teaching and learning. People are not aware of what can be done with the new medium and fall back on what they know. The result is usually a transition period during which practitioners' replicate known models by means of the new technology (Mioduser, Nachmias, Oren and Lahav, 1999). The new medium is different from traditional forms of teaching and learning and therefore requires new teaching strategies and expertise to make most effective use of it.

Not invented here

Practitioners often prefer developing a multimedia/online product which is tailor made to their teaching and learning requirements rather than adopting a product developed elsewhere to meet those same objectives (Bryant, 1998). Factors, which contribute to this preference, include product availability, cross-platform issues, product cost and personalised approaches to teaching and learning. Additionally, the effort and resources required to investigate the existence of potentially useful products can be very high (Bryant, 1998).

Organisational related issues

Research priorities

In practice, Universities continue to be research focused with arguably less importance placed on the teaching and learning function. Monetary policy, human resource policy, promotion paths and career progression requirements of academics seem to support this argument. Importantly evaluation of teaching and learning and subsequent reward for innovative and effective practice is limited. This perceived reality discourages staff from adopting new approaches to teaching and learning and from wanting to invest the considerable effort necessary to develop, design and support online teaching and learning.

Where funding and rewards are provided for innovative teaching the nature of this funding tends to encourage a small number of innovators, rather than the bulk of the practitioners. It is primarily project based and non-recurring. This perpetuates isolated innovative projects, which suffer the innovator/primary practitioner gap already discussed and exacerbate the subsequent lack of adoption and appropriation of innovative teaching practice on a broad scale.

Limited appropriation

Most Universities have a population of 'lone rangers', individual practitioners developing innovative online teaching and learning products. Due to a lack of institutional support and a failure to institutionalise inventive practice, these innovations remain at the level of specific course offerings (Taylor 1998).

Limited evolution

The complexity of teaching and learning on a large scale leads to the development of policies, procedures and support structures to guide the management of teaching and learning activity. Setting up these policies, procedures and support structures usually requires a considerable investment.   Not surprisingly, the people within these structures systematically resist attempts to alter their routines and their control over specific tasks (Hough, McNaught and Schaik, 1998). Consequently many of these policies, procedures and support structures are inflexible and do not readily adapt to changes in the environment or to the requirements of individual courses, staff or students.

Staff development

During 1997, only one third of respondents to a national survey believed that all training and development needs of university staff related to online teaching and learning were being met (Ellis, O'Reilly and Debreceny, 1998). The same survey identified that traditional methods of classroom presentation and tutorials were the favoured method of staff development. Attendance at staff development activities at CQU reveals the presence of the 'same old crowd', a small group of teaching staff who have an interest in improving their teaching through workshop attendance.

The reluctance to attend staff development workshops aimed at improving teaching and learning could be due to:

- the continued perception that discipline based research is more important than the teaching function

- teaching commitments and workloads disallow time for staff development

- the difficulty of organising a time, data or place (especially true at a multi-campus institutions like CQU) for staff development that suits everyone

- a fear of technology which makes prospective participants uncomfortable with teaching and learning approaches which require the use of technology. Their limited experience and subsequent feelings of inadequacy act as a barrier to participation.

Out of context decisions

Key decisions about the infrastructure and implementation of teaching and learning can be the responsibility of key administrators who may not have recent classroom practice. Given the recent changes in the context and practice of teaching at many institutions this can lead to quite significant differences in the goals and understandings which administrators and teachers bring to development projects. This goes beyond the obvious conflicts between a marketing, educational and economic rationale for pursuit of an online learning commodity to the structure of the learning package.

Empire building and divergent convergence

The digital revolution has seen different media converge to a single platform, the computer. However, the historic development of support divisions (computer support, video and audio production and multimedia development) within many institutions

has led to them being located and managed as competing empires. Organisational structures and a lack of co-operation often hinders convergent development.

Patterns for online learning—a possible solution?

We are investigating the application of a patterns-based approach as a solution to the difficulties and problems in the development of online teaching and learning materials. In addressing these issues it is possible to improve participation in online teaching and learning and meet the expectations of the medium.

What is a pattern?

A 'pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice' (Alexander, 1977). At a simple level patterns are a way of recording the knowledge of experienced practitioners, best practice and lessons learned. Patterns originated in the field of architecture but pattern use has since spread to include:

- pedagogy and teaching applications
- systems analysis
- hypermedia
- structuring organisations
- re-engineering systems
- project planning.

The use of patterns provides a number of benefits including:

- easier reuse of successful designs or ideas
- proven techniques are more accessible to developers
- enables choice between alternatives
- improves the documentation and maintenance of existing systems (Gamma, Helm, Johnson and Vlissides, 1994).

Patterns are documented using a particular format, which describe the rationale for the pattern, impacting forces, contraindications and outcomes of pattern usage. The use of consistent formats for the description of patterns makes it easier to learn, compare and use patterns (Gamma, Helm, Johnson and Vlissides, 1994). Appendix A is an example pattern which demonstrates a common pattern format.

Using patterns at CQU

The development and use of online learning patterns at Central Queensland University follows a five-step approach.

1. Pattern mining
   Good ideas are extracted from existing practice within CQU and the literature from a variety of fields including human-computer interface, pedagogy, multimedia design, project management, instructional design and web site management.

2. Pattern writing
   A pattern author attempts to extract and abstract the essence of a known solution to a common problem they face. A first draft of the pattern is presented at a writer's workshop. The writers workshop, which borrows a format from creative writing, is a positive, collaborative process where a number of other pattern writers offer positive suggestions for improving the pattern. At CQU the writers group consists of teachers, instructional designers, graphic designers, web masters and students.

3. Pattern catalogue
   Completed patterns are made available via a pattern catalogue which offers a number of different search methods to access, sort and select existing patterns. The current design for the CQU catalogue will be an electronic searchable database with a Web presence.

4. Template creation
   Selected patterns will be implemented as constructive templates (Nanard, Nanard and Kahn, 1998) within the Webfuse (Jones, 1999) online learning system. Unlike patterns, which are abstract entities, constructive templates are more descriptive and enable patterns to be put into practice. The variability of a good pattern means it can be implemented as many different constructive templates. Throughout the year 2000, the pattern catalogue and constructive templates will be available to CQU staff.

5. Pattern evaluation
   On-going evaluation of pattern use and other innovations will guide the mining, writing and use of patterns. At this time, a comprehensive evaluation process for pattern creation, adoption and use has not been formalised at CQU.

Addressing online development issues with patterns

The characteristics of patterns and the creation and application of patterns addresses a number of issues associated with the development of online teaching and learning materials. The following discussion highlights the different ways in which patterns can address the specific problems raised in this paper.

Pattern characteristics

Patterns are small (usually not much more than two pages) common solutions to a known problem in a particular context, which are described in a fixed format. They can be implemented in a variety of different ways depending on the practitioner's situation and specific needs. This makes them easier and more likely to be adopted and reused than a complete applet or website. A major advantage of patterns is that they provide a method to document and reuse experience and expertise. Patterns provide a common language by which practitioners can share and discuss ideas and thus reduce the effort involved in discovering applicable patterns. Patterns document abstract solutions to common problems, which can be implemented in a number of different ways.

A pattern catalogue is a collection of experience and expertise of real, practical applications of online teaching and learning. Being able to browse a pattern catalogue provides a practitioner with a relatively simple way of viewing what is possible and what is being done with online teaching and learning and a method to replicate these innovations. In this way, patterns can overcome the difficulties inherent in a new and changing online environment.

Creating patterns

Pattern writing at CQU is a collaborative, positive, bottom-up process in which practitioners from a number of different fields share their experience and knowledge. Involving online teaching and learning practitioners from many different fields in a writers workshops provides an opportunity for them to become familiar with the considerations of the different fields and become familiar with the people in these fields. Patterns are based on information gained from 'mining' the literature and existing practice. These aspects of pattern creation ensure we breach the field gap, address the difficulties of a new teaching environment and support broad appropriation of innovation.

The application of patterns will not address the mismatch in priorities between research and teaching at many Universities. However, they will make it easier to reuse good ideas and through constructive templates, provide tools to implement these ideas. The effort required for identifying and adopting emergent good teaching practice is also decreased. An important objective of the CQU patterning process is to generate publications by pattern writers thus supporting both improved teaching and learning practice and academic research requirements.

Application of patterns

Patterns are not simply descriptions of good systems. The application of patterns generates new systems and moves a system from some current context to a new context by resolving a number of forces. Ideally, the continual application of related and well-designed patterns generates a living structure capable of dynamically adapting to changing needs and demands (Jones and Stewart,1999). Additionally, on-going pattern mining and evaluation generates new patterns in response to new situations and contexts. A system based on the application of patterns evolves with time. The use of patterns is simple, especially when combined with constructive templates. The on-going evaluation of patterns implies an evaluative/reflective process, which is absent from some existing teaching and learning practice. An online pattern catalogue enables anytime, any place staff development.
Given that many educational practitioners place little value on educational research (Reeves, 1999) it can be difficult to justify theoretically based solutions as a part of staff development. Experience in the use of design patterns with software engineers, and early experience at CQU, indicates that it is very easy to demonstrate and justify to practioners the benefits of patterns (Goldfedder and Rising, 1996). This is due mainly to the simple nature of patterns and their emphasis on solutions to common problems from a concrete context. These characteristics have the propensity to break down barriers to adoption, application and professional development as previously discussed. The construction of a searchable patterns database (catalogue) with a website presence provides an avenue for self-paced professional development.

A pattern catalogue is a collection of experience and expertise of real, practical applications of online teaching and learning. Being able to browse a pattern catalogue provides a practitioner with a relatively simple way of viewing what is possible and what is being done with online teaching and learning and a method to replicate these

innovations. In this way, patterns can overcome the difficulties inherent in a new and changing online environment.

Conclusion

Patterns are not a panacea for issues associated with the development and support of online teaching and learning. The integration of appropriate pattern use and long-term management in the development of online learning initiatives will be a difficult process. Experience in other fields and initial experience at CQU, however, shows that the approach has a number of positive benefits. A development process for online teaching and learning commodities, which makes use of patterns, offers a bottom-up development process which places the emphasis on the experience and expertise of the practitioner. The patterning process also enables skill and design evolution, increases reuse of ideas and appears to address a number of the other issues associated with the development of online teaching and learning.

References

Alexander, C., Ishikawa, S. & Silverstein, M. 1977, *A Pattern Language: Towns, Buildings, Construction*, Oxford University Press.

Andersen, T. 1999, 'Utilizing Disruptive Technologies in the University: Confessions of an Agent Provocateur', *Proceedings of EdMedia'99*, Seattle, Washington, pp 22-30.

Bryant, S. 1998, 'Overcoming the 'Not Invented Here' Syndrome – Experience with Sourcing Educational Multimedia Developed Elsewhere', in *Flexibility: The Next Wave*, *Proceedings of ASCILITE'98*, Robert Corderoy (editor), pp 121-128

Ellis, A., O'Reilly, M. & Debreceny, R. 1998, 'Staff development responses to the demand for online teaching and learning, in *Flexibility: The Next Wave, Proceedings of ASCILITE'98*, Robert Corderoy (ed.), pp. 191-201.

Fernandez, E.B. 1998, 'Building systems using analysis patterns', *Proceedings of the Third International Workshop on Software Architecture*, pp 37-40.

Gamma, E., Helm, R., Johnson, R., Vlissides, J. 1994, *Design Patterns: Elements of Reusable Object-Oriented Software* Addison Wesley, Reading, Massachusetts.

Goldfedder, B. & Rising, L. 1996, 'Patterns: A training experience', *Communications of the ACM*, Vol. 39, No. 10, October, pp. 60-64.

Hough, G. McNaught, C. & Van Schaik, L. 1998, 'Developing a faculty plan for flexible delivery for the next five years—and how to get there', in *Flexibility: The Next Wave*, *Proceedings of ASCILITE'98*, Robert Corderoy (ed.), pp. 339-346.

Jones, D. 1999, 'Solving some problems with University Education: Part II', *Ausweb'99*, Balina, Australia.

Jones, D. & Jamieson, B. 1997, 'Three generations of online assignment management', in *What Works and Why, Proceedings of ASCILITE'97*, eds R. Kevill, R. Oliver & R. Phillips, pp. 317-323.

Jones, D. 1999, 'Webfuse: An Integrated, Eclectic Web Authoring Tool', to appear Proceedings of EdMedia'99

Jones, D. & Stewart, S. 1999, 'The case for patterns in online learning', in *Proceedings of Webnet'99*.

LaRose, R., Whitten, P. (1999) Building Web Courses with Instructional Immediacy. Proceedings of EdMedia'99, Seattle, Washington, pp 1436-1437.

Mendes, M. & Hall, W. 1999, 'Hyper-authoring for education: a qualitative evaluation', *Computers and Education*, Vol. 32, pp. 51-64.

McCormack, C. & Jones, D. 1997, *Building a Web-based Education System*, John Wiley & Sons, New York, USA.

Mioduser, D., Nachmias, R., Oren, A. & Lahav, O. 1999, 'Web-based learning environments (WBLE): Current state and emerging trends', *Proceedings of EdMedia'99*, Seattle, Washington, pp. 753-758.

Nanard, M., Nanard, J. & Kahn, P. 1998, 'Pushing reuse in hypermedia design: golden rules, design patterns and constructive templates', *Proceedings of the 9th ACM Conference on Hypertext and Hypermedia*, ACM Press, 11-20.

Taylor, P. 1998, 'Institutional change in uncertain times: lone ranging is not enough', *Studies in Higher Education*, 23(3), pp. 269-278.

Reeves, T. 1999, 'A research agenda for interactive learning in the new millennium', *Proceedings of EdMedia'99*, Seattle, Washington, pp 15-20.

Rogers, E. 1995, *Diffusion of Innovations*, 4th edn, The Free Press, New York.

Smeaton, A.F. & Crimmins, F. 1997, 'Virtual lectures for online Lectures: Delivery using RealAudio and the WWW', in *Proceedings of ED-Media/ED-Telecom*, pp. 990-995.

Taylor, P. 1998, 'Institutional change in uncertain times: lone ranging is not enough', *Studies in Higher Education*, 23(3), pp. 269-278.

Rogers, E. 1995, *Diffusion of Innovations*, 4th edn, The Free Press, New York.

Mendes, M. & Hall, W. 1999, 'Hyper-authoring for education: a qualitative evaluation', *Computers and Education*, Vol. 32, pp. 51-64.

Appendix A

Name: Intelligent reuse of existing practice

Problem: Individuals with existing educational resources and practice wish to make use of online teaching and learning but have limited resources, support and time.

Forces: Existing resources and practice are appropriate for another medium and may not be suitable for the online medium.

The educational literature suggests that learner-centred/constructivist approaches to online teaching and learning are most effective. For many practitioners, both staff and students, these approaches are high in complexity, low in compatibility with previous practice and can appear to offer limited relative advantage. Such innovations require significant effort to ensure successful adoption.

Teaching staff receive limited support or reward for innovative teaching and learning and accept existing practices due to significant barriers to innovation.

Many students simply wish to achieve a certain grade, not be forced to expend energy on becoming familiar with a new delivery medium.

The online medium provides many advantages including time independence, geographic independence, ease and immediacy of communication and alternative representations of concepts (text, audio, graphical). It also allows rapid computer manipulation of digital information.

Most academics want to address particular problems with their units while retaining some of the positives.

Solution: Adapt existing teaching and learning resources and practice for use in the online medium. The aim is to use the characteristics of the online medium to address specific problems and enhance the advantages of existing teaching practice. The emphasis is on achieving (for both staff and students) high compatibility with past practice, low complexity and high relative advantage.

Examples: Online assignment submission (Jones and Jamieson, 1997), uses the time and geographic independence of the online medium to reduce turn-around time, reduce the possibility of human error, and enable the use of computer manipulation and analysis of information. This maninpulation and analysis allows for automated marking. It also enables new practice including maintaining a central, long-term store of all student assignments.

Online/virtual lectures (Jones, 1999, Smeaton and Crimmins, 1997) allow the reuse of existing tools (powerpoint slideshows, video-taped lectures) to provide a lecture which can be repeated again and again under the student's control and be delivered to all students independent of time and location. Audio lectures can provide distance students, who are normally restricted to print, with alternative representations of information.

Resulting Context:	Through this approach both students and staff should receive a positive introduction to online learning which while familiar in practice has solved a number of previous problems and retained traditional advantages. This positive experience should encourage both staff and students to be more willing to adopt further online teaching and learning innovations. In particular since staff should at the end of this have a collection of resources, which will make it easier for them migrate to more appropriate uses of the online medium.
Rationale:	Diffusion of innovations theory says that an innovation is more likely to be adopted if it is low in complexity, high in compatibility and offers high relative advantage.
Related	This pattern will contain a number of component patterns such as
Patterns:	*Finding the Problems* and *Finding the Advantages* which offer advice on how to implement this pattern. Follow-on patterns might include *Resource-Based Learning*, *Problem-based learning* and other patterns which require staff or students to consider entirely new approaches to teaching and learning (Goldfedder and Rising 1996).