Towards a Pattern Language for Networked Learning

Peter Goodyear[1], Paris Avgeriou[2], Rune Baggetun[3], Sonia Bartoluzzi[4], Simeon Retalis[5], Frans Ronteltap[6] and Ellen Rusman[7]

University of Sydney[1], University of Cyprus[2], University of Bergen[3], A Priori Ltd[4], University of Piraeus[5], University of Maastricht[6], University of Netherlands[7]

ABSTRACT

The work of designing a useful, convivial networked learning environment is complex and demanding. People new to designing for networked learning face a number of major challenges when they try to draw on the experience of others – whether that experience is shared informally, in the everyday language of educational practice, or through published research and evaluation studies, or through sets of action-oriented guidelines. In this paper we present a novel approach to sharing educational design experience, making use of an organisational and communicative framework derived from Christopher Alexander's work on pattern languages. We describe the structure and purpose of design patterns, show how they fit together in a pattern language, and illustrate the approach with reference to some design patterns for networked learning. For clarity, our presentation is set within a specific conception of the nature of designing for networked learning, but we aim to show how the patterns-based approach transcends such particularities. We suggest that design patterns offer a useful method for sharing design ideas in participatory educational design work.

Keywords

Networked learning, design methods, design patterns, pattern language, higher education

OVERVIEW

An assumption underpinning the work reported in this paper is that designing for networked learning in higher education is a complex task which can benefit from better tools and methods. Existing approaches to supporting design are not very satisfactory. In particular, it is hard to strike an appropriate balance between rigour and prescriptiveness and to find appropriate levels of generality. Practitioners new to the area quite reasonably complain if the 'guidance' they are given appears too vague or is unsupported by research. Equally, they resist tight prescription - whether it be prescription of the technology to be used, or the pedagogical strategies to be employed.

The paper presents some outcomes of work from the EU-funded E-LEN project - work which has focussed on the idea of design patterns and a pattern language for networked learning. The original ideas for design patterns and pattern languages come from the writings of Christopher Alexander on architecture and town-planning - see, for example, Alexander (1979); Alexander et al (1977). Alexander's intention was to democratise architecture and town-planning by offering a set of conceptual resources that ordinary people could use in (re)shaping their environment. His work provides a principled, structured but flexible resource for vernacular design. In our view, he strikes the right balance between rigour and prescriptiveness - offering useful guidance without constraining creativity and providing helpful foci for design.

The notion of design patterns has been picked up more recently within the field of software engineering - where it has been used to capture and share aspects of software engineering experience and as a way of representing successful models for the implementation of information systems (see e.g. Gamma et al., 1995). Teachers of software engineering have also been experimenting with the idea of pedagogical patterns and educational technologists have been trying to apply a pattern-based approach to working on problems such as learning object descriptions, inter-operability, learning management standards, etc. (Lyardet et al., 1998; Eckstein et al., 2001; Frizell & Hubscher, 2002; Avgeriou et al., 2003).

This paper goes back to Alexander's work and attempts to provide (a) a concise summary of what is distinctive about the pattern-based approach and what it can offer to the task of designing for networked learning, (b) some example design patterns for networked learning, and (c) an account of how design patterns can be combined to form a pattern language.

Design patterns have a number of qualities which, in combination, give them the potential to be a useful way of sharing experience in the field of networked learning. A pattern is a solution to a recurrent problem in a context. In Alexander's own words, 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 et al., 1977, p.x). Context is important in helping constrain and communicate the nature of both problem and solution. Describing the context for the problem and its solution avoids over-generalisation. In addition, patterns should also teach. They should be written in such a way that they help the reader understand enough about a problem and solution that they can adapt the problem description and solution to meet their own needs. The rationale for the pattern helps with this teaching or explanatory function. Ideally, the name of the pattern should crystallise a valued element of design experience and help relate it to other design elements such that we can create and use a pattern language. The use of patterns, then, can be seen as a way of bridging between theory, empirical evidence and experience (on the one hand) and the practical problems of design.

To help make the pattern-based approach more readily comprehensible to people working in the field of networked learning, the paper refers to Morten Paulsen's pedagogical techniques for CMC rendered as Alexandrian patterns (Paulsen, 1995).

Design patterns are usually drafted, shared, critiqued and refined through an extended process of collaboration. The paper ends by inviting participants in the Networked Learning conference, and other interested readers, to contribute to this process over the coming months.

DESIGNING FOR NETWORKED LEARNING

An initial challenge in clearing the ground for an account of how design patterns can be of use in networked learning arises from lack of consensus about (a) whether systematic design is necessary and (b) whether systematic design is possible. In response, we acknowledge that it is certainly feasible to take one's first steps as a networked learning teacher without paying much attention to design issues. One can, for example, make use of other people's ideas for learning tasks and one can use networked learning tools or environments supplied by commercial vendors and managed by one's own university. But when preparing, say, a whole new course or programme of study, in which substantial use is to be made of networked learning methods, then the task begins to have sufficient complexity to warrant the careful planning and preparation activity that we call 'educational design' (van Merrienboer, 1997; Reigeluth, 1999; Goodyear, 2000). The discipline of instructional systems design (ISD) has, over the last 40 years or so, created and refined a number of methods and tools for tackling complex educational design problems. ISD methods have had little impact on the networked learning community, for a number of good reasons. The ISD approach tends to conceive of the learner as a passive object to be manipulated. It underestimates the complexity of learning processes and learning outcomes. It embodies a level of technical-rationality which is inconsistent with the messy compromises of collegial course and curriculum planning characteristic of university teaching cultures. ISD received a severe set-back from the neo-constructivist movement, which rightly objected to its behaviourist, manipulative and teacher-centered tendencies, but which failed to recognise that rich, authentic learning tasks and environments are even harder to design and need even more care with respect to design methods (Duffy & Jonassen, 1992).

Figure One helps conceptualise the problem space of design for networked learning. Agreement with the constructivist position – that each learner must construct their own understandings through an idiosyncratic process of meaning-making – is reflected in the pivotal position given to the learner's mental and physical activity. Socio-cultural accounts of learning are acknowledged through the significance given to the socially and physically situated nature of the learner's activity. This focuses our attention, as educational designers, on three areas: the learner's activity; the social relationships and social interactions within which that activity is situated; the affordances of tools and other artefacts in the physical environment (the 'learnplace'). Figure 1 also captures another important feature of design for networked learning – a feature which distinguishes it from traditional ISD. Figure 1 asserts that one should not aim to 'design' the learner's activity. One should design good learning tasks, but see these as resources the learner uses in deciding what to do. The task does not prescribe the activity. (Students will never do what we tell them; nor should they. Neither should we give them a blank canvas.) Similarly, we cannot and should not try to 'design' the social relationships or the culture or learning community. Rather, our design effort should focus on the creation of organisational forms which will favour the emergence of convivial learning relationships. Finally, we should try to create a supportive 'space' of well-designed tools and artefacts, while recognising that students will configure their own personal 'learnplace' in ways which we cannot predict.

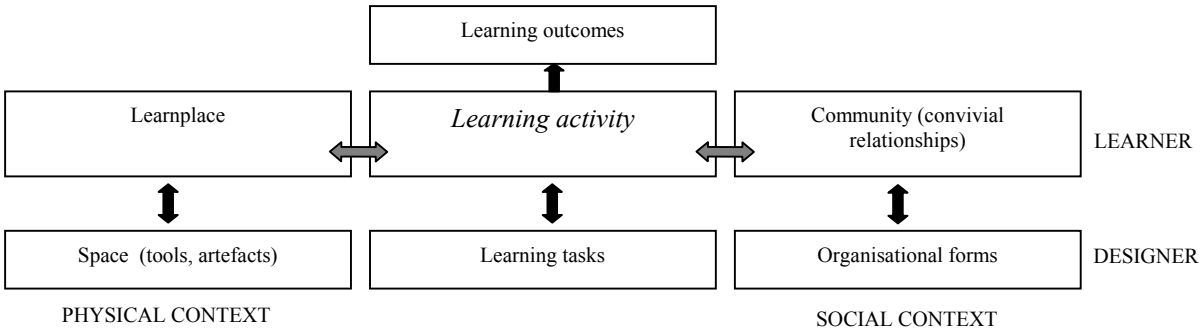

Figure 1: Designing for networked learning (adapted from Goodyear, 2000).

There are other ways to conceptualise the problem space of educational design, but for clarity of exposition, we will use the approach sketched in Figure 1 as the background for discussing the role of design patterns.

VALUES AND PATTERNS

A distinctive feature of Alexander's use of patterns in architecture and town/regional planning, and one which distinguishes his approach from much of what has been done subsequently in the field of software engineering, is his explicit commitment to a set of values which characterise well-being, and a good social and physical environment. His position is explicitly value-laden, though he roots his case in a biologically-based analysis of the environmental causes of stress in modern life. It is our view that the pedagogies and technologies of networked learning are similarly value-laden, though these values are not always brought to the surface and there is some doubt about the legitimacy of doing so (see Jones et al., 2000). There is a common, though in our view naïve and unsustainable, belief that guidance about networked learning should be pedagogically (and even morally) neutral.

Alexander grounds his account of well-being in a discussion of 'the quality without a name'. This quality is evoked by, but is more than the sum of, a set of values connoted by the terms 'alive', 'whole', 'comfortable', 'free', 'exact', 'egoless' and 'eternal' (Alexander, 1979, 25-40). Alexander is careful to say that each of these words also sets off contrary resonances – 'freedom' is too dramatic, 'comfortable' too cosy, 'wholeness' is too enclosed. The key point is that we all have a sense of this 'quality without a name' and we can think of favourite places which evoke and embody it (see Appendix, extract 1). Sadly, it is even easier to think of places which have none of this quality –where the drivers of modern life (profit, speed, privacy, consumption…) suck places dry of their vitality and beauty. Inhabiting such places, in Alexander's view, creates unmanageable tensions and stresses in our lives and relationships.

One way of developing this theme, to bring us back to networked learning, is to consider our students' lives, how we cause their work to be distributed over time and space, the conviviality (or otherwise) of the learning environments in which they find themselves, and the stresses and tensions we visit upon them. Bad buildings create stress. Good building nurtures. Bad technology exacerbates the tensions in students' lives. Good technology provides ways of softening a harsh environment.

We need a concrete example. Imagine a part-time postgraduate course for full-time teachers. It is held two evenings a week for 26 weeks in the year. Two days a week the teacher-students must work a full day in school, then drive to the over-crowded campus of their city-centre university. They struggle to find a place to park. The refectories are shut. The classroom in which they meet is ill-furnished, badly lit, over-heated, laid out for lecturing rather than groupwork. Some teacher-students arrive late; others must leave early. Groupwork is interrupted, discussion is desultory. The lecturer – also tired – recommends some new reading at the end of the evening. The library is already closed. In any case, only one copy is available of each of the key texts and there are twenty people in the class. The teacher-students head home, with no time or energy to socialise or even learn each other's names.

This bleak picture is all too familiar. The resilience of the arrangements and problems described above is not due to lack of care or ignorance on the part of the lecturer, nor simply to lack of money. The problems persist because they cannot be dealt with piecemeal – a complete redesign is necessary.

What should be done? We must question the need for face-to-face meetings when they take such a toll on the participants. What purposes should they serve? How few will be enough? How should they be organised and resourced to achieve the narrower set of purposes? We must ask what the teacher-students need to learn. What should they be trying to learn from the lecturer? What from each other? What from reading? Experimenting? Reflecting? What time scales and resources are needed for each of these?

From such questions we may arrive at a set of key propositions: that the professional learning of teacher-students requires a robust engagement between experiential and research-based knowledge; that the teacher-students, as experienced professionals, are well-placed to share their experiential knowledge and to collaborate in the construction of richer and more powerful forms of working knowledge; that knowledge-sharing and the mutual critique of practice demand trust; trust depends on knowing one's peers for an extended period of time; knowing one's peers depends on chances to interact – in the classroom as well as in the pub or café. Bringing research-based knowledge (theory, evidence) to bear on the analysis of professional practice is difficult and time-consuming. It needs periods of intense, private, mental effort – supported by access to literature and to vivid representations of practice. It needs opportunities to clarify one's understanding of complex ideas: by questioning others, risking one's uncertain understanding in the heat of debate, explaining, predicting and engaging fully in the whole olympiad of epistemic games. More could be said, but our immediate purpose is to show how this cashes out in terms of patterns, pattern languages and the three components of educational design.

Turning first to *tasks*, we can begin to identify the kinds of things it would be useful to propose to the teacher-students:

- Identifying and describing critical incidents in one's recent practice (creating shareable representations of practice)
- Placing these representations in a shared repository
- Reviewing, analysing and annotating other teacher-students' representations
- Reading selected articles from the research literature; making personal sense of their key ideas; relating these to critical incidents in the repository of shareable representations of practice
- Finding other relevant articles from the research literature
- Proposing improvements to practice; sketching means of implementing these

In relation to *organisational forms*, we would need to attend to design issues such as:

- The number and mix of teacher-students needed to create a critical mass – to create a sustainable, active but knowable and intimate learning community
- The time needed for the community to emerge, establish norms and trust, get on with its work, approach closure on issues in professional practice
- Methods for the allocation of roles within the learning community,
- The pattern of meetings in time and space, etc.

In relation to *space* and place, we would need to resolve design issues such as:

- The tools needed to manage a common repository of shared representations of practice, and annotations thereon
- Selection of other communication tools
- Identification and equipping/arrangement of appropriate (physical) spaces for face-to-face meetings: classroom, café, library rooms, pub.

The list is far from complete, but it is enough to allow us to look at how some relevant design ideas can be expressed as patterns, and then to see how these may be combined in a pattern language.

PATTERNS FOR NETWORKED LEARNING

Alexandrian patterns have the structure shown in Figure 2. (See for example, Alexander et al, 1977, x-xi.)

A picture (showing an archetypal example of the pattern) [easier in architecture than networked learning]

An introductory paragraph setting the context for the pattern (explaining how it helps to complete some larger patterns)

◆◆◆ (to mark the beginning of the problem)

A headline, in bold type, to give the essence of the problem in one or two sentences

The body of the problem (its empirical background, evidence for its validity, examples of different ways the pattern can be manifested)

The solution, in bold type. This is the heart of the pattern – the field of physical and social relationships which are required to solve the stated problem in the stated context. Always stated as an instruction, so that you know what to do to build the pattern.

A diagrammatic representation of the solution

◆◆◆ (to show the main body of the pattern is finished)

A paragraph tying the pattern to the smaller patterns which are needed to complete and embellish it.

Figure 2: the structure of a typical Alexandrian pattern.

An example pattern relating to networked learning is given in the Appendix (Segment 2), below. The example is taken from a set of patterns we have developed to represent the pedagogical techniques summarised and popularised by Morten Paulsen (Paulsen, 1995). These techniques cover 'one-alone', 'one-to-one', 'one-to-many' and 'many-to-many' scenarios. The 'many-to-many' techniques are: DISCUSSION GROUPS; DEBATES; SIMULATIONS or GAMES; ROLE PLAYS; CASE STUDIES; TRANSCRIPT BASED ASSIGNMENTS; BRAINSTORMING; DELPHI TECHNIQUES; NOMINAL GROUP TECHNIQUES; FORUMS; PROJECT GROUPS; JOINT PROGRAMME AND JOINT COHORT DISCUSSIONS and VISITOR EXPERTS. The full set of patterns can be obtained from the E-LEN website or from the first author of this paper.

What the example in the Appendix should begin to do is convey a sense of how design patterns can work as a method of encapsulating design experience and research-based ideas, rendering them available for re-use in concrete design problems.

OUTLINE OF A PATTERN LANGUAGE

But design patterns on their own are rather hard to evaluate and to use. They gain a great deal of meaning and strength from their position in a structure, and especially a sequence, of other patterns. Alexander's seminal contribution consisted of 253 patterns, ranging in scale from an INDEPENDENT (geographical) REGION to an ORNAMENT. He called the whole assemblage a pattern language, but also uses smaller pattern languages for specific projects (such as building a porch – for which he provides a pattern language consisting of just ten patterns).

Thinking in similar ways about the design space of networked learning, we can advance some tentative proposals about an equivalent pattern language. What would be the largest pattern, equivalent to Alexander's INDEPENDENT REGION? We suspect it would be a course, or PROGRAMME OF STUDY. This is the largest entity which can be designed. At smaller scale levels there are the building blocks of a course, however one labels them in one's own system or institution – STUDY UNIT, MODULE, etc. Then there are the kinds of pedagogical technique catalogued by Paulsen: DISCUSSION GROUP, DEBATE, etc. Within these are smaller pedagogical tactics (tasks), smaller organisational forms, as well as the tools and artefacts with which we populate the learning space.

Forming a pattern language for networked learning involves painstaking, iterative work, travelling in two directions. From the bottom up, we can sketch individual design patterns, to capture recurrent problems and solutions from our collective experience as networked learning practitioners, interpreting these also through the lens of research-based evidence and theory. From the top down, we can try to structure the problem space of design, scoping out the largest and smallest patterns, and sketching relationships between patterns (written and as yet unwritten). Neither approach is sufficient on its own and each can lead to contradictions and problems for the other – hence the need for iteration, revision, patience and a tolerance of ambiguity.

TAKING THE PROCESS FORWARD

The development and dissemination of design patterns and pattern languages is a collaborative activity, usually extending over several years. Online tools (such as wikis) and face-to-face events (such as the EuroPLOP meetings) are becoming part of the infrastructure for pattern development, in a variety of disciplines and areas of design practice. The E-LEN project has made some progress in scoping the problem of expressing design

issues in networked learning in terms of a pattern language, but there is much more work to be done. The community that has formed around the series of Networked Learning conferences is an ideal constituency for taking this work forward. If you are interested in helping with this task, please contact the lead author or visit the E-LEN website.

ACKNOWLEDGMENTS

We gratefully acknowledge the contribution of the European Union Minerva programme which has part-funded this work through its grant to the E-LEN consortium.

REFERENCES

Alexander, C. (1979). The timeless way of building. New York: Oxford University Press.

Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I., & Angel, S. (1977). A pattern language: towns, buildings, construction. New York: Oxford University Press.

Avgeriou, P., Papasalouros, A., Retalis, S., Skordalakis, E. (2003) Towards a Pattern Language for Learning Management Systems, Educational Technology & Society, 6, 2, 11-24, http://ifets.ieee.org/periodical/6-2/2.html

Duffy, T., & Jonassen, D. (Eds.). (1992). Constructivism and the technology of instruction: a conversation. Hillsdale NJ: Lawrence Erlbaum Associates.

Eckstein, J., Marquardt, K., Manns, M., & Wallingford, E. (2001). Patterns for experiential learning. Paper presented at the EuroPLoP 2001 conference.

Frizell, S., & Hubscher, R. (2002). Supporting the application of design patterns in web-course design. Paper presented at the ED-MEDIA 2002 conference.

Gamma, E., Helm, R., Johnson, R., & Vlissides, J. (1995). Design patterns: elements of reusable object-oriented software. New York: Addison-Wesley.

Goodyear, P. (2000). Environments for lifelong learning: ergonomics, architecture and educational design. In J. M. Spector & T. Anderson (Eds.), Integrated and Holistic Perspectives on Learning, Instruction & Technology: Understanding Complexity (pp. 1-18). Dordrecht: Kluwer Academic Publishers.

Jones, C., Asensio, M., & Goodyear, P. (2000). Networked learning in higher education: practitioners' perspectives. Journal of the Association for Learning Technology, 8(2), 18-28.

Lyardet, F., Rossi, G., & Schwabe, D. (1998). Using design patterns in educational multimedia applications. Paper presented at the ED-MEDIA '98 Conference.

McConnell, D. (2000). Implementing computer supported cooperative learning (2nd ed.). London: Kogan Page.

Paulsen, M. (1995) The on-line report on pedagogical techniques for computer-mediated communication (http://home.nettskolen.nki.no/~morten/cmcped/litrev.html)

Pilkington, R & Walker, S. (2003) Facilitating debate in networked learning: reflecting on online synchronous discussion in higher education, Instructional Science 31(1-2), 41-63.

Reigeluth, C. (Ed.). (1999). Instructional design theories and models Vol 2: a new paradigm of instructional theory. Mahwah NJ: Lawrence Erlbaum Associates.

van Merrienboer, J. (1997). Training complex cognitive skills: a four component instructional design model for technical training. Englewood Cliffs, NJ: Educational Technology Publications.

Wertsch, J. (2002). Computer mediation, PBL and dialogicality. Distance Education, 23(1), 105-108.

APPENDIX

Segment 1: Alexander's evocation of 'the quality without a name'

'The first place I think of, when I try to tell someone about this quality, is a corner of an English country garden, where a peach tree grows against a wall. The wall runs east to west; the peach tree grows flat against its southern side. The sun shines on the tree, and as it warms the bricks behind the tree, the warm bricks themselves warm the peaches on the tree. It has a slightly dozy quality. The tree, carefully tied to grow flat against the wall; warming the bricks; the peaches growing in the sun; the wild grass growing around the roots of the tree, in the angle where the earth and roots and wall all meet.' (Alexander, 1979, 25).

This evocation precedes Alexander's attempt to describe 'the quality without a name'. We may not want our students to doze, but it is worth considering how we would write a parallel description of, say, their first experience with WebCT.

Segment 2: Pattern for 'Discussion Group'

Discussion group

This pattern is mainly concerned with the establishment of appropriate organisational forms for knowledge-sharing, questioning and critique. It is a way of helping implement the patterns LEARNING THROUGH DISCUSSION, COLLABORATIVE LEARNING and NETWORKED LEARNING PROGRAMME.

◆◆◆

Discussion groups are the most common way of organising activity in networked learning environments. The degree to which a discussion is structured, and the choice of structure, are key in determining how successfully the discussion will promote learning for the participants.
Discussions can be relatively structured or relatively unstructured, and they may also change their character over a period of time. It is not uncommon for a teacher to set up a discussion in quite a formal or structured way, and for the structure then to soften as time goes by – for example, as the participants take hold of the conversation, opening up and following new lines of interest.

The structure of a discussion should be such that it increases the likelihood of:

a) an active and substantial discussion, with plenty of on-task contributions

b) the students coming away from the discussion with a good understanding of the contributions made

c) contributions being made by all members of the group and 'listened' to by all other members of the group.

Unstructured discussions run the risks of (for example)

- not getting going properly within the time available
- dissipating into a number of loosely related strands that fail to engage effectively with subject being studied
- dissolving into monologues or two-way conversations that fail to involve the whole group (Wertsch, 2002).

Pilkington & Walker (2003) have demonstrated the value of assigning explicit group roles in online discussion groups. Some writers, for example, McConnell (2000) are not sure about the validity of the teacher setting specific structuring devices, preferring to make the group itself responsible for determining how it wants to discuss things, or carry out its work more generally.

Therefore:

Start any online discussion by establishing its structure. Make the rules and timetable for this structure explicit to all the members of the group. Where there is little time available to the group for the discussion, and/or the members of the group are inexperienced at holding online discussions, the teacher/facilitator should set the structure. Where the students are to set their own structure, the teacher/facilitator should give them support and ideas about how to do this, and encourage them to do so in a fair and timely way.

◆◆◆

Patterns needed to complete this pattern include: DISCUSSION ROLE, FACILITATOR, DISCURSIVE TASK