Design patterns for computer supported groupwork

Kashmira Dave
CoCo Research Center
University of Sydney

This paper describes work-in-progress in the area of educational design patterns. More specifically, the paper highlights a relatively neglected area in educational design for technology-supported learning – the various ways in which students can be grouped together to work collaboratively on study activities. Thus, it looks at the 'people' component of the 'task, tools and people' design model. The paper outlines this design model, sketches the 'people' component and offers an example design pattern to illustrate how design knowledge can be shared through design patterns and pattern languages. The research has implications for anyone who is concerned about sharing good ideas for technology-supported collaborative learning, whether in small, medium-sized or large groups (from dyads to learning communities).

Key words: educational design, patterns, social organisation, group work, large classes

Conceptualising 'teaching-as-design'

Teaching and learning in higher education has shifted its focus from *what teachers say* to *what students do*. Student-centered active learning is becoming a more important focus for teaching. What students do is the most important determinant of what they learn. This requires teachers to design good learning tasks, which align with intended learning outcomes (Biggs, 2007). Good task design must be accompanied by careful consideration of the learning environment: paying attention to such things as the affordances of learning places, the tools and resources that should be available, etc. Design also needs to take into account the ways in which students might work together, whether in pairs, small groups, teams or communities. Designing learning tasks, and the accompanying considerations of the learning environment and learning partners, has to be seen as a complex challenge for teachers – one which should involve careful thinking as well as creativity. This idea of 'teaching-as-design' (Goodyear & Retalis, in press) is being shaped and necessitated by some major changes in higher education: larger classes, worsening staff-student ratios, growing diversity in the student population, changes in technology and rising expectation about graduate capabilities are all putting extra pressure on the teacher and on traditional teaching practices. When these stresses become too great, traditional methods can no longer cope, and educational innovation becomes a necessity.

Educational design and design components

Instructional design is an established term, but one that has not gained much currency among university teachers, partly because they see it as a rather narrow and specialised professional practice that makes strong assumptions about the nature of teaching (instruction) and learning (reception). While this may not be a fair criticism of instructional design, it is clear that few university teachers would describe part of what they do as 'instructional design'. 'Learning design' has gained in popularity as a term, partly because it emphasises learning rather than instruction, but it implies that learning can be designed or delivered. Learners have to do the learning: other people can help create supportive environments for learning, and suggest good things to do. For this reason, the term 'educational design' is preferred to 'learning design' or 'instructional design'.

Educational design can be considered as a set of practices involved in constructing representations of how to support learning in particular cases (Goodyear, 2005). These representations can be converted into real

support materials and tasks. Design can be best understood as an *indirect* practice, which does not directly create the students' activity. Rather, it creates good learning tasks and plans for the setting in place of the physical and human resources that can help learners succeed with such tasks.

Figure 1 shows that the mental and physical activity of the students is central to the study situation. Productive activity needs an appropriate physical and social learning environment. This learning environment subtly plays a decisive role in shaping the activity and the desired outcome (Goodyear & Retalis, in press).

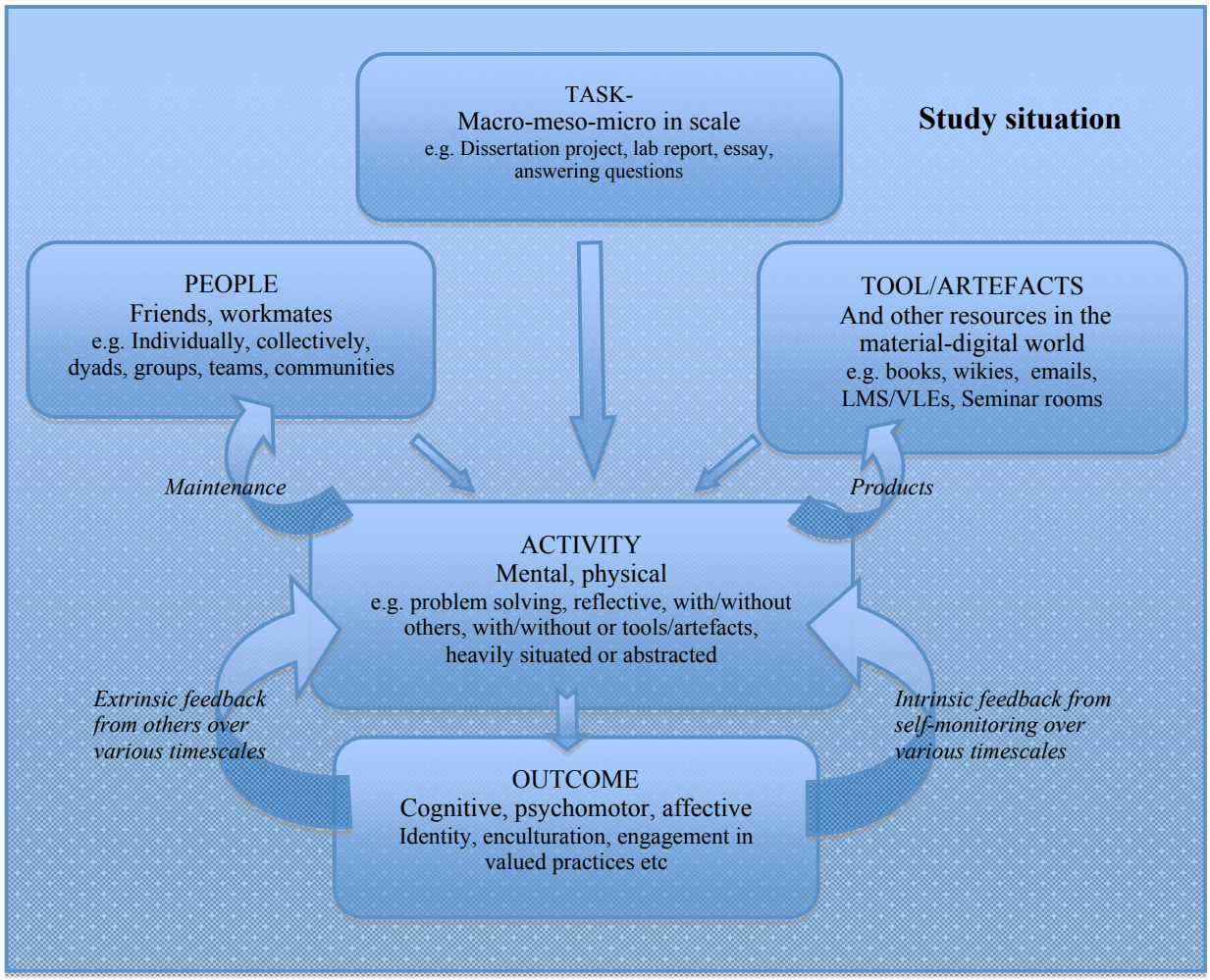

Figure 1: Conceptualising the problem space of educational design
(adapted from Goodyear & Retalis, in press)

A neglected area in design theorising: Social organisation/divisions of labour

Figure 1 is one way of depicting the problem space of educational design. Of the three main design components (which we can label, for brevity, tasks, tools and people), the people component has been relatively neglected. That is to say, there has been a great deal of work on task design, which helps map tasks to activities to intended learning outcomes. There is also a large literature mapping between activities and tools (though rather less between activities and learning places). There is relatively less work mapping between tasks and 'people'. This needs to be said carefully. There is, of course, a very large literature on educational groupwork and collaborative learning (Slavin, 1985). There is a very active line of research into online learning communities and other forms of computer-supported collaborative learning (Kirschner, Martens, & Strijbos, 2004) . What hasn't received much attention is the *systematic* consideration of the multiplicity of ways in which educational activity can be distributed between students, including through cross-cohort, cross-disciplinary and cross-institutional divisions of labour. Although there are many case-studies and anecdotal accounts of creative ways in which teachers get students to work together, it has to be said that university communities are generally very weak when it

comes to internal social structures. Cross-year mentoring or teamwork, allocation of distinctive roles in the academic community, designed variations in who does what (the division of labour) within course or year groups can be found, but they are exceptions. Equivalence of role and status is the norm. While one can understand the necessity for treating students fairly, it does not necessarily follow that the virtual absence of role differentiation and planned divisions of labour is always in the students' best interests. This 'vanilla' treatment of students in higher education practice is reflected in a paucity of design theorizing about the 'people' component of educational design. For example, there has been little systematic work on it in the area of design patterns and pattern languages (Goodyear & Retalis, in press). A goal of my current PhD research is to help fill this gap.

Large classes as a site for study

Worsening staff-student ratios have been accompanied, in many universities, by increases in class sizes, especially in the area of first year undergraduate studies. Class sizes of over a thousand students are not unknown. Classes in the middle hundreds are relatively common. In such situations, it is impossible for the course coordinator (a term I use to label the academic who has overall responsibility for the course) to know or even interact with all of their students, or even a substantial fraction of them. Coordinators of large courses are usually assisted by other lecturers, graduate students and/or casual teaching staff, who help out with such jobs as marking assignments and leading tutorial groups. Coordinating the work of this team, and trying to ensure quality, can be very demanding for course coordinators, and there are signs of stress emerging within the system (see e.g. Kift, 2003; House of Commons, 2009). Moreover, there are good reasons to believe that being lost in the anonymity of large classes is detrimental to students' sense of engagement and identity.

This makes research on large classes a fruitful site for the design of the 'people' component in the educational design model portrayed in Figure 1. There is a pressing need here for help with better ways of engaging students in a variety of roles, groups, teams and (sub-) communities. This is not to say that the 'people' design component is irrelevant in small courses – far from it – but the scope and need for innovative arrangements is more pressing in large classes. As part of the opening work for my PhD, I have created a blog which is acting as a collecting point for ideas about teaching large classes in tertiary education [http://largeclass-groupwork.blogspot.com/]. Work currently under way is a preparation for constructing and testing design patterns and pattern languages that help with the 'people' component of design, especially but not exclusively in the context of large classes. An important part of the challenge is to help teachers escape the traps of large class teaching – a context in which many teachers appear to believe that there are few or no options other than the mass lecture. The PhD project aims to (a) gather strategies for grouping students in various ways (b) abstract the essence of these strategies and (c) encode them into design patterns that can be used to share teachers' experience. A strong motivator for this work is that many of the ambitious graduate attributes demanded of university students are difficult, if not impossible, to develop in mass lecture settings (Goodyear & Retalis, in press).

Design patterns and pattern languages

The idea of design patterns comes from the writings of Christopher Alexander et al., working in the area of architecture and town planning. A design 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, Ishikawa, & Silverstein, 1977). Patterns are not algorithms that generate a design specification, but should be considered as recommendations for good design (Goodyear, 2005) that can be altered, expanded or compressed (Alexander, et al., 1977).

Goodyear claims that the patterns based approach can offer educational designs, which support the teacher with comprehensive sets of design ideas. Patterns can present design ideas in structured manner so that the relationship among the different components of the design can be easily understood. Patterns describe problem and solution at the same time and put forward the rationale, which can create a clear link between pedagogical philosophy, research-based evidence and experiential knowledge of design. Patterns can encode the knowledge in such a way that it supports iterative, fluid processes of design (Goodyear, 2005).

An essential feature of patterns is that they help balance competing design forces. For example, consider the situation where a teacher-designer creates a task with two goals: 'to teach Newton's third law of motion' and 'to help students improve their group-work skills'. The classical instructional design method

would be to take a step-by-step approach to deal with each goal, one at a time. Pattern-based design has the potential to enable the teacher-designer to balance these competing goals in a single task, in a flexible and creative manner. Patterns also help to shift design power from technical experts to the teachers and learners who inhabit educational spaces (Alexander, et al., 1977; Goodyear, 2005).

BRAINSTORM GROUP

This group task pattern is useful in situations where students are working in small to medium sized groups (say, 4-8 students) and where an opportunity is needed for pooling everyone's ideas. It can be useful in DISCUSSION-BASED LEARNING, COLLABORATIVE INQUIRY, PROJECT-BASED LEARNING (F2F, online or blended).

◆◆◆

"None of us is as smart as all of us", the saying goes. One of the advantages of working as a group derives from the fact that people have different ways of looking at a problem and are collectively able to contribute a broader range of ideas than will be brought forward by any one individual. It's useful to have a time-efficient method of pooling such ideas especially when people need to generate creative ideas. However, it sometimes happens that a group will prematurely start evaluating the suggestions made by the first few people to speak. This means that some members of the group are not heard, and can feel marginalised. It can also mean that the group focuses on early, perhaps more obvious, ideas; fewer ideas are generated than may be needed; the best ideas may not get heard at all.

Group work activates prior knowledge and helps members build on the ideas of others, to construct knowledge (Killen, 2003). Bowering et al have conducted a study on the value of individuals' contributions to the group (Bowering, Leggett, Harvey, & Leng, 2007). The authors concluded that it is valued among the members of the group. Students thought the small group activities were very valuable to share each other's ideas and experiences. The strategy was also considered effective for exploring other's views and for reflective practices. However, Bowering et al showed their concerned about the possibility that activity might be too challenging for the cohort when it comes to examine and develop consensus on the ideas came out of brainstorming.

In the group work, it is not only important to gather and share ideas but also the ideas need to be examined or tested. We can't assume one of the ideas is the best solution/answer to the problem. The risk also lies if one of the member's ideas is not heard (which could be the best of all), which not only make the member feel neglected but also affect the outcome of the task. Some the strategies can help enhance the group work. It is crucial to clarify the role of CHARIPERSON and SCRIBE and other members of the group and their expectation from each other.

The CHAIR PERSON in the beginning can give general outline of the process e.g. the clarity of the problem, the time limit for member to work on problem, suggest groups have a person (SCRIBE) to record the ideas/thoughts and so on (Oakley, Felder, Brent, & Elhajj, 2004). The CHAIRPERSON might also alert the groups on consequences of undermining any member's idea or marginalising them. For the success of the groups, teacher should plan the class time and form the group with members having diverse abilities (Deibel, 2005). Clarity of role, division of labour and expectations among the members is critical. Communicating the ideas clearly encourages critical thinking (Karl, 2000).

Some of the practical consideration has to be made for the success of the groups. Apart from time limit available for the activity, teacher needs to consider the availability of physical and human resources (e.g. appropriate space for the discussion, tools/material required for the activity human resource etc)

The group can be ideally 4 to 8 depending on the type of activity. Group usually follows lecture, panel etc. There is flexibility in the duration of the groups depending on the need of the subject and/or the learning.

Therefore:

Divide the work of the group into three phases. A CHAIRPERSON manages the process. In the first phase, each person in turn has to make a suggestion relevant to the problem at hand. A SCRIBE makes a note of each idea on a DISPLAY BOARD. The chairperson must not allow any discussion of the ideas during this first ideas-generation phase. Proceed around the group until ideas are exhausted or until the allotted time runs out. In the second phase, group discussion should focus on each of the ideas in turn, clarifying what is meant, merging ideas where the group agrees they are virtually identical, and evaluating strengths and weaknesses. The chairperson must manage this process too. In the third phase, the group must select the best ideas, according to some agreed criteria. This may be done by discussion, or may need a vote.

◆◆◆

Patterns needed to complete this pattern include: CHAIRPERSON, SCRIBE, DISPLAYBOARD

Figure 2: Brainstorm group

Individual design patterns are combined to form a 'pattern language', tailored to the requirements of a particular task – such as designing an extension to a house, or designing a new program of study (Goodyear & Yang, 2008). Alexander (1977) stressed that the pattern in itself is incomplete without other connecting patterns. A pattern language is a set of patterns together with connective rules that preserve

the large-scale coherence of the design as a whole (Salingaros, 2000). For designers or academics to use design patterns effectively, they need to have some practice with whole pattern languages, not just isolated patterns (Voigt, in press).

Pattern languages provide a context for guidance about what to do. E.g. a larger pattern provides a context for smaller patterns, and for the guidance contained in them. In Figure 2 the smaller patterns like *chairperson, scribe* and *display board* make sense in the context of the larger pattern *Brainstorm group.*

Figure 2 is an *example* of a draft pattern about a brainstorming group. The *structure* of this pattern is as suggested by Alexander. Alexandrian patterns typically have a title, brief context, statement of the problem, body, and solution to the problem. Each pattern ends with a description of the other smaller patterns, which are needed to complete this pattern.

Next steps

As mentioned earlier, there is little available research in the area of educational design that specifies the people component of the design space in detail. My aim is to find out how patterns work as a way to express design ideas and how teachers may use it to capture/share/communicate their teaching experience.

Acknowledgment

My sincere thanks to Prof. Peter Goodyear for his help, guidance and encouragement while writing this paper.

References

Alexander, C., Ishikawa, S., & Silverstein, M. (1977). *A pattern language: Towns, buildings, construction*. New York: Oxford University Press.

Biggs, J. B. & Tang, C. (2007). *Teaching for quality learning at university: What the student does* (3rd ed.). Maidenhead: McGraw-Hill/Society for Research into Higher Education & Open University Press.

Bowering, M., Leggett, B., Harvey, M., & Leng, H. (2007). Opening up thinking: Reflections on group work in a bilingual postgraduate program. *International Journal of Teaching and Learning in Higher Education, 19*(2), 105-116.

Deibel, K. (2005). Team formation methods for increasing interaction during in-class group work. Paper presented at the Proceedings of the 10th annual SIGCSE conference on Innovation and technology in computer science education.

Goodyear, P. (2005). Educational design and networked learning: Patterns, pattern languages and design practice. *Australasian Journal of Educational Technology, 21*(1), 82-101. http://www.ascilite.org.au/ajet/ajet21/goodyear.html

Goodyear, P., & Retalis, S. (in press). Learning, technology and design. In P. Goodyear & S. Retalis (Eds.), *Technology-enhanced learning: Design patterns and pattern languages*. Rotterdam: Sense Publishers.

Goodyear, P. & Yang, D. F. (2008). Patterns and pattern languages in educational design. In L. Lockyer (Ed.), *Handbook of research on learning design and learning objects: Issues, applications, and technologies* (Vol. 1, pp. 167-187). Hershey PA: Information Science Reference.

Karl, A. S. (2000). Going deeper: Formal small-group learning in large classes. *New Directions for Teaching and Learning, 2000*(81), 25-46.

Killen, R. (2003). *Effective teaching strategies: Lessons from research and practice* (3nd ed.). Katoomba, NSW: Social Science Press.

Kirschner, P. A., Martens, R. L., & Strijbos, J.-W. (2004). CSCL in higher education? In S. Jan-Willem, P. A. Kirschner & R. L. Martens (Eds.), *What do we know about CSCl and implementing it in higher education* (pp. 3-30): Kluwer Academic Publishers.

Oakley, B., Felder, R., Brent, B., & Elhajj, I. (2004). Turning student groups into effective teams. *Journal of Student Centered Learning, 2*(1), 9-34.

Salingaros, N. A. (2000). The structure of pattern languages. *arq: Architectural Research Quarterly, 4*(02), 149-162.

Slavin, R. E. (1985). *Learning to cooperate, cooperating to learn*. New York: Plenum Press.

Voigt, C. (in press). A pattern in the making. In P. Goodyear & S. Retalis (Eds.), *Technology-enhanced learning: Design patterns and pattern languages*. Rotterdam: Sense Publishers.

Author: Kashmira Dave, CoCo research Center, Faculty of Education and Social work, University of Sydney. Email: kdave@edfac.usyd.edu.au

Please cite as: Dave, K. (2009). Design patterns for computer-supported groupwork. In *Same places, different spaces. Proceedings ascilite Auckland 2009*.
http://www.ascilite.org.au/conferences/auckland09/procs/dave.pdf