Practical Design Patterns for Teaching and Learning with Technology

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Trails in Education: Technologies that Support Navigational Learning

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This book is about sequences of learning objects ordered according to time or according to the demands of given learning materials. As users navigate through a learning environment, they follow prescribed trails and create personal trails through their interactions. In digital learning environments, these trails can be stored, evaluated and accessed in a structured manner. Experts from different backgrounds shed light on different aspects of trails and navigational learning. Its chapters contain an investigation on how planning and evaluating trails can support curriculum development, a review of personalised learning and collaborative learning, a model which tackles issues relating to knowledge acquisition and cognitive aspects of trails, and a demonstration of how trails can be visualised.

The target audiences are: professionals, practitioners and researchers interested in educational science, e-learning and computer-enhanced learning, computing in education, curriculum studies, instructional design, or computer-supported personalised and collaborative learning.

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INTRODUCTION: USING DESIGN PATTERNS TO DEVELOP AND SHARE EFFECTIVE PRACTICE

Education aspires to bring about change; whether to change individuals and societies, or to change knowledge, attitudes, and practices. The act of devising plans of activities, resources, and tools to achieve such change is an act of learning design. This book sets out to share design knowledge about the use of technology in teaching and learning, and to explore how we might best share this design knowledge amongst educators, but also between educators, researchers, and technology developers.

The first part of this chapter, entitled *Design for Learning,* is directed at practitioners who wish to use this book to access, use and modify existing patterns. The second part of the chapter, entitled *A methodology for developing design patterns,* contains some more technical and specific information for those who are interested in the methods by which we derived these patterns and who wish to apply them in the development of new applications of technology to teaching and learning, or in research.

DESIGN FOR LEARNING

> Teaching is not rocket science. It is much, much harder than that. Rocket science is about moving atoms from a to b; teaching is about moving minds (Laurillard, 2012, p. 5).

Teachers face learning design challenges throughout their practice, and new design challenges are continuously thrown up both by new topics and by the use of new technologies. The advice available to support teachers in this task of learning design is usually either provided in the form of pedagogic theory, or in the form of anecdotal descriptions of someone else's practice. The first approach is usually too general and abstract to be useful and the second is often too ad hoc or context specific to be easily applicable more broadly. The teacher is left with the hard tasks of operationalising the theory on the one hand, or of determining what is relevant and what irrelevant detail in the second. There is an acute need to find effective ways of sharing design knowledge, particularly if practitioners are to make any headway in building on the success of others in a cumulative manner. Design patterns provide a way of addressing this issue by providing guidance which is abstracted from practice and informed by theory in a way which makes them more easily translated into effective

practice. The concept of a design pattern was originally developed by Alexander (Alexander et al., 1977), in the field of architecture. He argues that 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".

This book is a collection of such design patterns for the use of technology in teaching and learning, which can be used by educators to help them design effective educational practice. It provides a set of practical and usable design ideas that, rather than being prescriptive, provide open solutions to concrete needs, and that can be modified and developed.

We used the Participatory Pattern Workshops (PPW) methodology (which will be described in more detail in the second part of this chapter) as the means to develop these patterns. These workshops were practical in that they were closely related to teachers' everyday practice, and participatory in that they were driven by participants' professional experience.

HOW TO USE THIS BOOK

The primary way of using this book is as an off-the-shelf problem-solving resource for educational practitioners, identifying patterns that meet their needs. The patterns are not set recipes, a practitioner may apply the same pattern many times, each time in a different way. Each pattern is accompanied by design narratives that set the wider context in which the patterns were developed, and by scenarios which project forward to possible novel applications of the patterns, illustrating how they can be adjusted to these new situations.

A second way of using the book is as a straightforward literature, a cohesive set of ideas supporting reflection on the application of technology to learning, and the challenges and potentialities that arise.

Finally, we hope that practitioners will find inspiration in this book to follow a similar process of identifying cases of problem-solving in their own work, extracting patterns, and using these as a vocabulary for design level conversations in their professional environment.

THE STRUCTURE OF THE BOOK

The book contains four sections addressing the themes of *Learner centred design*, *Learning communities*, *Social media and learner interaction in social spaces*, and *Assessment and feedback*. In each section we have brought together a set of design patterns around a theme, together with design narratives from which they were derived and scenarios in which these patterns are applied to new contexts. These form the basis for a set of related patterns which we describe as a 'pattern language' for that theme. In order to get as clear an expression as possible of the patterns,

each narrative and pattern was peer reviewed by other contributors to the book, and 'shepherded' by the editors, whereby authors were given continuous support in their development of the patterns through multiple iterations of refining their text. Despite these attempts to develop consistency, the reader will find that each section adopts a slightly different style of presentation, so for example the patterns in *Assessment and feedback* section are perhaps less abstracted than those of the other sections. We present below a brief account of the patterns which are described in each of these four sections, as a guide to the content of those sections, and to enable the reader to more quickly identify areas of interest. The names of the patterns discussed are indicated in capital letters so that they can be readily identified.

Learner centred design

In this section of the book we present a set of six patterns related to the theme of learner centred design. These patterns are highly diverse in terms of how they relate to the learning and teaching process. The INTERACTIVE LECTURE MODE pattern can potentially be used to design a complete course, whereas the SPOTLIGHTING LEARNING PROCESSES and SHOWCASE LEARNING patterns are intended to be used as adjuncts to the existing teaching-learning activities in a course. The REACTION SHEETS pattern is meant as a companion activity to a course's core teaching and learning activities. The ACADEMIC WRITING SKILLS pattern focuses on the learners' individual backgrounds and is most powerful in multi-cultural and multi-lingual settings. Finally, the CONTENT MORPH pattern focuses on enabling teachers and researchers to transfer good educational ideas for student-oriented designs across topic areas.

Learning communities

In this section of the book we present a set of six patterns related to the theme of learning communities. The pattern COURSE DESIGN AS A COLLABORATIVE LEARNING ACTIVITY analyzes the needs and the different roles needed to succeed in managing online collaboration for designing a course. The pattern GROUP HOME RE-LOCATION describes the factors that need to be considered in selecting the tools that best fit the needs and preferences of team members. Two patterns address the challenges thrown up by cross-cultural communication. First, the pattern CROSS-CULTURAL MEDIATOR which describes the mediating role of a person who is familiar with the different cultures involved and second, LOCAL COMMUNITY MEETING where students come together in local meetings to discuss their experience of different cross-cultural teams. The pattern GROUP LEADER EMERGENCE describes the role of leadership in self organising groups, and WATCH ACTIVE MEMBERS encourages facilitators to validate active team member's contributions to online discussions.

Social media and learner interaction in social spaces

In this section of the book we present a set of nine patterns related to social media and learner interaction in social spaces. Drawing on the description by Jenkins et al.

(2007) of the concept of a culture of participation, these patterns are organised into three groups representing aspects of participation.

– Designing – the three patterns in this group describe problem solving approaches to building environments that support productive participation. ONLINE FORUM FOR ELEARNING outlines the logical design structure and teaching practices involved in the creation of an asynchronous online learning forum. CAN YOU HEAR ME highlights the importance of understanding how virtual communication channels differ from real world settings. CHOOSING THE RIGHT BLEND considers the choices that need to be made in selecting tools and providing ways to negotiate their use.
– Scaffolding – the three patterns in this group relate to the process of moving isolated individuals towards productive social interaction within groups. SET GROUND RULES outlines the foundation and baseline expectancies that need to be addressed in advance of running a synchronous text-based chat session. WEAR YOUR SKILLS ON YOUR SHIRT acknowledges that collaboration is dependent on participants indicating their skill set. TOUCH POINTS proposes a game-based format for helping students come to an understanding of how others perceive, react to, or share their visions, actions and understanding.
– Communicate – the three patterns in this group relate to managing the channels for synchronous and asynchronous communication. NO TELLER WITHOUT LISTENERS highlights the importance of being an active listener and the need to draw out less active users from lurking through to participation. CONTROL THE FLOW addresses the mechanics of synchronous text-based chat and finally DO AS I DO describes how students can learn to relate to one another and become encultured into an online community and learning environment

Assessment and feedback

In this section of the book we present a set of eight patterns related to assessment and feedback. A framework based on the key strategies for formative assessment identified by Black and Wiliam (2009) is used to structure the presentation of the patterns.

– Three patterns are related to the formative assessment strategy 'Engineering effective discussions, tasks and activities that elicit evidence of learning'. BLENDED EVALUATION brings together a variety of forms of evaluation in an assessment. CHAOTIC MULTIPLE CHOICE TEST is designed to reduce guessing in multiple choice question tests and to reduce effort in test construction. E-GEO-ASSESSMENT combines assessment standards with the use of an open web map service (WMS) in order to create new types of questions to enhance the assessment of geographical skills.
– Two patterns are related to the formative assessment strategy 'Providing feedback that moves learners forward'. FEEDBACK ON FEEDBACK provides a means of improving tutors' feedback to students so that it provides opportunities to improve the learning experience. FORMATIVE EXCEPTION: CLOSING THE LOOP FOR EXCELLENT

STUDENTS addresses the issue of providing feedback to students who are already doing well on a course, feedback that would help these students to replicate this performance across different contexts and situations.

– One pattern is related to the formative assessment strategy 'Activating students as learning resources for one another'. GENERATE & USE AGREED STRATEGIES is a pattern in which students review and develop their own strategies for tackling a set of tasks through a series of small group and whole group interactions.

– Two patterns are related to the formative assessment strategy 'Activating students as owners of their own learning'. TRY ONCE, REFINE ONCE describes a two-step question-answering system which encourages students to carefully consider their initial answers and on receiving feedback on their errors, to give careful thought to the refinement process. HINT ON DEMAND makes hints accessible to students, but only when they actively demand them and not before they have started working on the task.

USING THE PATTERNS

This book, therefore, presents four pattern languages on the themes of *Learner centred design, Learning communities*, *Social media and learner interaction in social spaces*, and *Assessment and feedback*. Though we have presented these patterns in as consistent a manner as possible, it will be clear to the reader that some of the patterns are better developed and articulated than others, some draw heavily on practitioner voices and others more on researcher and developer voices, and we may not always have succeeded in bringing these into a coherent relationship with each other. This, therefore, remains work in progress and there is scope for further development, but that is the nature of design patterns. It is now for others to try to use these patterns, to refine them, develop and add to them.

A METHODOLOGY FOR DEVELOPING DESIGN PATTERNS

The reader can, without prejudice to his/her ability to understand the rest of the book, or to use and modify the patterns presented there, skip the following section, which presents further details of our methodology, its theoretical and empirical background, and its future directions. This section will perhaps be of most interest to developers, and researchers in education, technology and design who will find it useful as an introduction to a design-based methodology which connects research to practice.

Why design patterns?

Designing effective educational technology and technology-based activities is a daunting challenge (Beetham & Sharpe, 2013; Mor & Winters, 2007). This is because the technology and the educational practice need to co-evolve and thus no designer

has a fixed reference point. Ideally, technology should allow all stakeholders in the educational endeavour – learners, parents, teachers, educational designers and policy makers – to constantly experiment and improve their practices, thus becoming partners in a continuous culture of participatory educational design. This is only possible if we can find ways for discussing education, and technology's role, at a design level: to describe situations and the challenges they espouse, identify possible solutions to these, and discuss them in a critical manner.

The challenge is even greater when several actors are involved in the development and implementation of an educational intervention. Here, where responsibilities are divided between parties, they must find a common language for collaboration and co-ordination at the design level in order to create meaningful learning and teaching experiences.

Thus we are confronted with the complicated challenge of capturing and sharing distributed and dynamic design knowledge in education. This knowledge relates to the design of tools, activities, social configurations, and the synergies between them. Our solution to addressing this problem is through the iterative development and use of design patterns.

The last decade has witnessed a growing acknowledgement of the design pattern paradigm for research and practice in the learning sciences (for examples see: Bergin, 2000; Goodyear et al., 2004; Brouns et al., 2005; Retalis et al., 2006; Mor & Winters, 2008; Winters & Mor, 2009; Bergin et al., 2012). Most recently, Laurillard (2012) has presented an argument that teaching itself should be seen as a design science, and that by representing and communicating their best ideas as structured pedagogical patterns, teachers can develop their professional knowledge collectively. This book builds on this growing tradition, and adopts a specific methodology which is described in the following section.

The Participatory Pattern Workshops Methodology

The Participatory Pattern Workshops (PPW) methodology is a product of reflection on scores of workshops conducted over several years (Mor 2013; Mor & Winters 2009; Mor, Winters & Warburton 2012).

The workshops are practical in the sense of 'related to practice', and participatory in the sense that patterns are developed by practitioners. These workshops have ranged from one-off events of several hours to series of three to five encounters, each one up to a full day. Each event or series has been dedicated to a particular theme, and the primary outputs were relevant to the participants interested in that theme. These outputs included design narratives, design patterns and design scenarios of varied maturity. They also included the insights the participants derived from their experience that allowed them to perceive their domain with a new perspective: a design view that transcended the clutter of daily detail, but was still readily applicable for them and their peers. It is here that the power of design patterns becomes visible

via their non-prescriptive nature. This allows experts to share their knowledge without imposing a singular method of solution.

In order to enable a culture of critical, informed and reflective design practice we need a framework for communicating design knowledge: the knowledge of the characteristic features of a domain of practice, the challenges which inhabit it, and the established methods of resolving them. Several representations have been proposed to this effect: design narratives (Mor, 2010; Barab et al., 2008), design principles (Kali, 2006, 2008; Linn et al., 2004), and design patterns (Derntl & Motschnig-Pitrik, 2005; Goodyear, 2005; Mor & Winters, 2007; Retalis et al., 2006). The PPW methodology utilises two of these – design narratives and design patterns - and projects the first into the future, to form a third representation – design scenarios.

Design Narratives   Design narratives illustrate a critical problem by demonstrating its manifestation and resolution in a concrete context. They are first-person accounts of practitioners' experience detailing a challenge they have faced and successfully overcome. These include both technology experts developing new technologies for learning, and educators finding effective ways of using technology in their practice.

Design narratives provide a 'thick description' of a design experience, allowing critics to assess the validity of the designers' claims, and trace them back to evidence. At the same time, design narratives provide sufficient contextual information for those who wish to apply a similar design in proximal settings, be they fellow designers or practitioners wishing to learn from the experience.

Design Patterns   Whereas design narratives represent design knowledge extracted from empirical evidence, capturing and interpreting the designers' experience. Design patterns attempt to organize this knowledge into modular structures.

Design patterns distil the reusable elements of design from distinct cases, so that they can be immediately applied in new situations. A design pattern captures a recurring problem, the context in which it occurs, and a possible method of solution. They are derived from experience and backed by theory, abstracted one step away from the concrete yet still applicable to real-life situations.

The design patterns paradigm (Alexander et al., 1977) was developed as a form of design language within architecture. This was done with the explicit aim of externalizing knowledge to allow the accumulation and generalization of solutions and to allow all members of a community or design group to participate in discussions relating to design. These patterns were organized into coherent systems called pattern languages where patterns are related to each other. The core of a design pattern can be seen as a local functional statement: "For problem P, under circumstances C, solution S has been known to work". Such a structure reads like a direct generalisation of the narrative form, when that narrative is a record of a problem solving effort, in other words, a design narrative.

Design scenarios   Scenarios demonstrate the application of patterns to hypothetical problems. Whereas design narratives report on past experiences, scenarios present current and future challenges facing practitioners. They are used as test cases to demonstrate the validity and utility of patterns.

Design scenarios offer a suitable representation for projecting design claims into the future, posing hypothetical statements regarding potential challenges and possible solutions. They borrow the form of design narratives, adapting it from an account of documented past events to a description of imagined future ones. The context describes a current, existing situation, which is perturbed by the introduction of new material, social and intentional elements such as new technologies, new practices, or new objectives. Consequently, the challenge component may describe an existing conflict of forces, which is altered by the introduction of new contextual elements. The protagonists in a design scenario do not need to refer to specific individuals in the real world, but they must describe persons who could, convincingly be present in the domain of practice being explored and be ascribed with the intentions and social relations included in the described context.

Patterns for the Participatory Pattern Workshops methodology

The PPW methodology can be represented in its own terms, that is, as a language of pedagogical design patterns. At the heart of the methodology is the participatory pattern workshops pattern, which describes the interrelation between a series of collaborative reflection workshops, typically: a design narratives workshop, a design patterns workshop and a design scenarios workshop. These patterns are described in detail in Mor, Winters, and Warburton (2010), which includes templates for narratives and patterns, and links to exemplar presentations.

Projects

The projects through which the PPW methodology has been developed include:

– The Pattern Language Network (Planet) project (funded by JISC) which produced over 100 design narratives, close to 30 design patterns and 13 scenarios. A number of the patterns in this book were first developed in that project, and the archive of the project wiki at http://web.lkldev.ioe.ac.uk/patternlanguage/xwiki/bin/view/Main/ forms a valuable resource which we will reference a number of times in this book.
– The Learning Patterns project (a Jointly Executed Integrating Research Project of the Kaleidoscope Network of Excellence) produced around 25 design narratives and 150 patterns, some of which were published in Mor (2010).
– The Formative E-Assessment project FEASST (funded by JISC) produced ten patterns (Daly, Pachler, Mor & Mellar, 2010; Mor, Mellar, Pachler & Daly, 2010).
– The Mobile learning for Development (ML4D) project (funded by the Higher Education Innovation Fund) investigated ways to provide development practitioners with the capacity to design their own mobile learning activities.

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– The MUVEnation project (funded by the EU) produced 28 design patterns, over 80 design narratives and more that 20 design scenarios about the use of immersive virtual worlds for learning and teaching (Warburton, 2009).
– The Rhizome project (funded by Eduserv) produced 11 design patterns and more than 25 design narratives in the domain of digital identity management (Warburton, 2010).

Future Directions

The Participatory Pattern Workshops methodology is a work in progress. How robust is the methodology described here to the constraints of particular situations? When would it be effective, and when would it be overkill? Our experience suggests that the methodology is robust and versatile. Participatory workshops are probably not the most cost-effective means of collecting and disseminating design knowledge, as any participatory process by definition is a time intensive activity. On the other hand, the workshops offer participants significant personal benefits, in terms of their professional development, and they produce outputs which reflect the social and individual knowledge assets of participants. The prospect of using and constructing design scenarios, narratives, and patterns as a framework for professional development of educators is currently being explored in the development of the Learning Design Studio model (Mor & Mogilevsky, 2012) and the emerging model of teacher led design inquiry of learning.

The work within some of the projects here, notably MUVEnation, has suggested that an online setting for collaborating in design pattern generation can be successfully used. By deploying both synchronous and asynchronous mechanisms for virtual collaboration there is an exciting potential to extend the reach of the PPW methodology, opening up design pattern generation to a wider audience. In this way we can foresee larger networks of domain experts coming together to build, share and evolve design patterns, enhancing their quality and robustness.

A key future challenge resulting from design pattern generation is the role of abstraction (Winters & Mor, 2009): how will practitioners use the PPW methodology to develop generalisable solutions from their own experiences? It will be interesting to see the how patterns presented in this book can be used and iterated upon in different contexts, at different levels of abstraction. It is only when this question in answered through pattern use that we will be able to judge the success of our endeavour.

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1. LEARNER CENTRED DESIGN - OVERVIEW

New technologies and high user adoption rates are pushing developers of social and educational tools to unprecedented productivity rates. When a teacher plans to employ these new tools and technologies, he/she will find an abundance of uses and design options. This has resulted in the teacher's design task becoming increasingly complex.

While installing and using new tools are simple tasks, the real challenge lies in finding the value-added ways of integrating cutting-edge tools and methods in educational practice. Without a sound pedagogic base to build upon, the selection and use of tools will merely create an online mirror image of what we already know from 'traditional' teaching and learning - a grim image which shows all lines of control tied to the teacher and the resources he/she provides. One pedagogic approach that may guide decision making in a complex, multi-faceted, and continuously evolving environment is the learner-centred approach. In a learner-centred educational environment, the ultimate goal of the designer/teacher is to put the learner and his/her learning process at the centre of every decision during design and delivery.

How can this be achieved? Clearly, this means catering for diverse learner needs and characteristics, provision of a setting of authenticity and inclusion, openness to experience and personal growth, co-creation of knowledge, and personal regard for each individual. The main goal is to facilitate learners in becoming active, self-directed and self-responsible **participants** in the learning process, in which peers and the instructor serve as facilitators, motivators and personal resources. From a teaching and design perspective, this is a very complex and demanding endeavour. As an entry aid for interested practitioners, this section includes five patterns and accompanying design narratives which offer handy pieces of advice in helping them move towards a learner-centred mindset.

The pattern INTERACTIVE LECTURE MODE (1.2.1), along with its accompanying design narrative (1.1.1), addresses the learners in the potentially least learner-centred of all educational experiences: the lecture. Even within this teacher-directed and inactive learning context there is room to support self-directed, deep and meaningful learning. The pattern helps the design and implementation of an interactive mode of lecturing in academic courses by including a complementary strand of activities, in which students team up to solve problems of practical and personal relevance related to the subject of the lecture. They are supported by interactive virtual team spaces and an electronic diary (or e-portfolio) service. They are offered room for exploration and personal as well as interpersonal reflection. The pattern and the

design narrative embody many core principles of learner-centred design, making it a demanding, yet potentially highly rewarding experience. Learners are going through a process of constructing meaning from information and experience. They pursue personally relevant goals by engaging in a self-chosen topic, and they are guided towards strategic, higher-order thinking since they are reflecting on their learning process. They are intensively facilitated in their complex problem solving processes, in which they work in teams and thus also experience social influences on learning by interacting, negotiating and communicating. Last, but not least, they are stakeholders in the process by co-determining the goals and assessment criteria for their projects.

Whatever the predominant teaching mode on a course, the pattern SPOTLIGHTING LEARNING PROCESSES (1.2.2) can be used to promote a similar kind of student learning community. This pattern takes advantage of the availability of blogging tools on the web, the use of which is embedded into the course environment, as in the lab course in which students work both individually and in teams described in the design narrative 'Lab Course on Software Architectures and Web Technologies' (1.1.2).

The advantage for the tutor is that this published account is a means to track each student's, or each group's, developing thinking, their conceptual difficulties, and their approaches to the plans and problems they confront as they carry out their independent work on the course. The advantage for the student is that, being published on the course site, their accounts are accessible to other students, so they can see what others are doing to tackle similar problems, give and receive comments, and also receive on-going formative advice from the tutor. The challenge is to make this potentially rich exchange happen, and the pattern offers guidance on how to set up and encourage this regular and productive exchange of ideas, problems and solutions.

The products of blogs are also valuable because they can be used to populate e-portfolios, which offer a more structured way of tracking student progress. They could also be used for the pattern SHOWCASE LEARNING (1.2.3). The aim of this pattern is to celebrate the output from student learning because the products that students create as part of their coursework assessment are typically seen only by the marker, and yet in many cases they represent a great deal of work, and are of great interest to other students who have been grappling with the same kind of assignment. As in the case of blogs, however, it is not just the product that is of value, but the process as well, and this pattern emphasises the value not just of showcasing final products but also of the failed attempts along the way from which the student learned. Products can take many forms – material, digital, performances or events. The pattern addresses the issues of planning and logistics, as well as the potentially difficult issues of diversity and inclusion.

The pattern REACTION SHEETS (1.2.4) presents a useful activity that can be employed as a companion in virtually all courses. Students are encouraged to reflect on the course units and share their reflections (i.e. the reaction sheets) with the facilitator and with peers. The idea is to solicit honest feedback on the current state of the course.

The reactions are considered as input to the following course unit, thus empowering students to co-shape the process. The power of this pattern is that it is fairly easy to include, yet highly powerful in shaping a community of learners and teachers. By considering and hearing learners as individuals with their own meanings, opinions and creative power, 'reaction sheets' can be a truly learner-centred add-on to every course.

The pattern ACADEMIC WRITING SKILLS (1.2.5) has a somewhat different flavour from the first four patterns. It addresses students with a non-native speaking background who have language difficulties in academic writing for specific subjects. The pattern is derived from a design narrative (1.1.5) in which non-English speaking background (NESB) students are facilitated in developing skills enabling them to write well-formulated use cases for computer science projects. The pattern proposes a genre-based approach to help students understand the nature and type of text they are writing. From a learner-centred perspective the pattern strongly addresses factors of individual difference in student learning by acknowledging that language, ethnicity and other cultural aspects affect learning, and that learners' achievements and motivation are enhanced when their linguistic, cultural and social backgrounds are taken into account.

The pattern CONTENT MORPH (1.2.6) is different again. The pattern is designed for teachers to use so that they can capitalise on a learner-centred learning activity that takes the form of a game, and transfer its design to different topic areas, thereby increasing the value of the original design. The replacement of topic content in a game format is risky because the internal relationships between the objectives, the activities and decisions made in the game, and the structure of the topic content must be preserved when the new content is inserted. This pattern provides the means by which the appropriate transfer of content can be assured. The design narrative from which this pattern is derived describes a mathematical game for a particular problem, but shows that the design of the game is suitable also for a different topic area with the same problem structure. For teachers who wish to develop further student-oriented applications from an effective original the pattern provides useful guidelines on how to do this in a way that does not distort the structure and design of the original educational game idea.

The six patterns are highly diverse in terms of how they are embedded into learning and teaching. The INTERACTIVE LECTURE MODE pattern can potentially be used to design a full course for a whole semester. Both SPOTLIGHTING LEARNING PROCESSES and SHOWCASE LEARNING could be used as adjuncts to the existing learning and teaching activities in a course. THE REACTION SHEETS pattern is more meant as a companion activity to the course's core learning and teaching activities. The ACADEMIC WRITING SKILLS pattern focuses particularly on the learners' individual backgrounds and is most powerful in multi-cultural and multi-lingual settings, which are becoming increasingly prevalent in a globalised educational and corporate world. Finally, the CONTENT MORPH pattern focuses on enabling teachers and researchers to transfer good educational ideas for student-oriented designs across topic areas.

Readers who are interested in reading more about the psychological underpinnings of learner-centred education are referred to McCombs and Miller (2006) and Rogers (1983).

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1.1.1 DESIGN NARRATIVE: INTERACTIVE LECTURE MODE OF THE HUMAN-COMPUTER INTERACTION LECTURE

SUMMARY

This design narrative provides the source for the pattern interactive lecture mode. It illustrates the implementation of the INTERACTIVE LECTURE MODE pattern in a Human-Computer Interaction lecture course which was part of an undergraduate study program at the University of Vienna. Students could choose one of the two possible 'modes' of the lecture, the 'traditional' lecture including regular oral presentations held by the instructor and a final written exam, and the 'interactive' lecture mode including the completion and documentation of a team project, keeping an electronic diary and a final oral presentation. In order to improve their grades (towards A – very good, or B – good), students who participated in the interactive lecture mode could take the final written exam if they wished to do so.

SITUATION

The Human-Computer Interaction lecture was a course of the bachelor curriculum of Computer Science, offered at the University of Vienna. Additional to a laboratory course on Human-Computer Interaction assigned with two ECTS (European Credit Transfer and Accreditation System) points, the lecture was offered as a course with four ECTS credit points taught in three hours per week during one semester. Frontal teaching for three hours per week offered potential for including activities in which students could be engaged and involved with other activities that support deeper learning and continual feedback.

TASK

The task was to offer an option for students who wanted to actively engage in the subject matter and who wanted to receive continuous feedback on how they were doing during the semester. This learning opportunity or lecture mode should be linked with the 'conventional' lecture mode ending with a final exam. The conventional lecture mode took place in the same course and was offered to students not interested in active participation in the course during the semester.

ACTIONS

At the beginning of the lecture, students had to sign up for the interactive lecture mode. The course was supported by the learning environment CEWebS (Cooperative Environment Web Services) which offered a blog as an extended functionality in order to enable writing online diary entries. CEWebS provided team spaces as well, where teams could upload their contributions and peer-evaluate contributions of other participants or teams. In a wiki module contributions could be collaboratively elaborated. Another CEWebS function allowed the development and collection of questionnaires, which enabled online self-evaluations by means of writing statements and grading one's own learning achievements (Mangler & Derntl, 2004).

Students were asked to build teams with a maximum of three members per team and to elaborate team project proposals. Students were asked to briefly describe the topic of their project, their motivation and the context, as well as the intended goals of the project in their project proposals. Furthermore, students were asked to describe the way the team wished to solve the identified problem, the intended outcomes of the project, the allocation of resources and a rough schedule of the activities necessary for the successful completion of the project. Criteria for the team project were:

– The team project illustrates an in-depth elaboration of one or more core topics of Human-Computer Interaction and Psychology as presented in the lectures.
– The team project follows clearly defined objectives.
– The team project includes a literature review, as well as practical examples and illustrations of their own experiences that support and/or critically question theories.

The team project proposals were reviewed and assigned by a tutor. During the team project work phase, three work-in-progress inspections of particular project contributions were done by the tutor. In the last unit of the lecture, students presented their team projects. The aim of the presentations was to provide some insight into the topics and results elaborated by the participants of the interactive lecture mode to other students of the course. These presentations were addressed to all students, including those who did not participate in the interactive lecture mode. Furthermore, participants of the interactive lecture mode regularly wrote entries into their electronic diaries. They were instructed to adhere to four e-portfolio phases (Peterson et al., 2007): personal state of knowledge and experiences, continuous reflection, experiences collected in the team project and in the lecture, and final reflection. They could decide whether they allowed read permission for all participants of the course or only for the instructor. We suggested to our students that they write about 100-300 words per entry and that they not spend more than one hour per week on this activity. As an incentive to participate in the interactive lecture mode, participants could achieve in the best case the grade C (satisfactory) without final written examination. In order to improve their grade (to B – good, or A – very good) students had to pass the final written exam. The points were added to the points collected in the interactive lecture mode. Students who did not participate in the interactive lecture mode took

the final written exam at the end of the lecture but had no additional points. Figure 1 presents a flowchart of the students' activities of the interactive lecture mode as conducted in the Human-Computer Interaction and Psychology course.
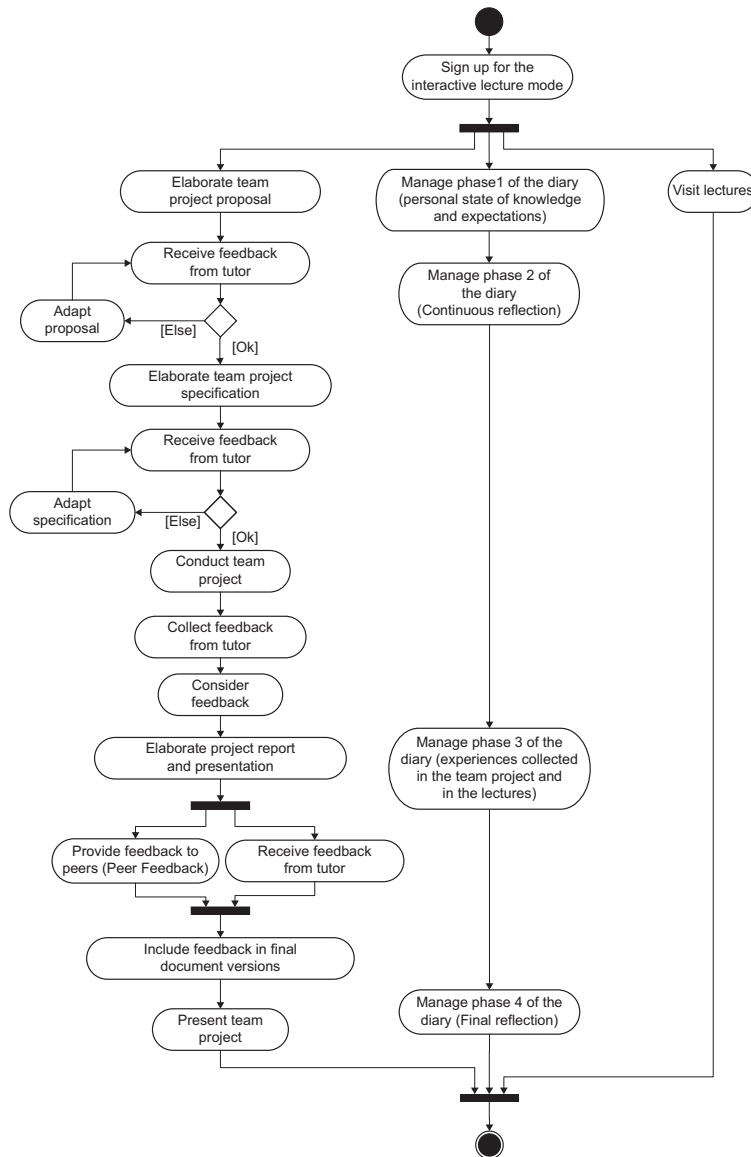

Figure 1. Students' activities of the interactive lecture mode as conducted in the Human-Computer Interaction and Psychology course.

RESULTS

In summer term 2008, 116 students participated in this course and 31 of these students signed up for the interactive lecture mode. 74% of the participants in the interactive lecture mode successfully passed the course. Empirical findings which resulted from a qualitative content analysis of students' reflections on the course are summarized in Kabicher, Kriglstein, Figl and Motschnig (2008). It was found that students often expressed a positive attitude to Human-Computer Interaction (44 statements) and some of the statements referred to the interactive mode (26 statements), particularly to learning, time requirements and grading. Students explained, for example, that the interactive mode:

– offered them the possibility to learn the subject more effectively (12 statements)
– required more work than the 'traditional' lecture with a final examination (8 statements)
– was not graded clearly or fairly enough (6 statements).

LESSONS LEARNED

We learned from the experience and the feedback of our students participating in the interactive lecture mode that we could offer them the possibility of learning the subject matter more effectively, but that the interactive lecture mode asked for more work to be done than seemed to be necessary in the conventional lecture with one final exam. Furthermore, we learned that the grading and assessment modes of the interactive lecture mode need to be clearly communicated, offering an incentive for students to participate in it. We also learned that legal regulations may make it necessary to integrate the final exam as a requirement into the interactive lecture mode.

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1.1.2 DESIGN NARRATIVE: LAB COURSE ON SOFTWARE ARCHITECTURES AND WEB TECHNOLOGIES

SUMMARY

In a computer-science lab course on software architectures and web technologies I tried to introduce student blogs as an opportunity to attain deeper insight into individual and team learning processes and to provide improved support and facilitation of learners during the online phases of the course. The research activities around this project were supported by the 'Technology Enhanced Learning' project funded by the University of Vienna (See http://elearn.pri.univie.ac.at/projects/tel/).

SITUATION

This was a third-semester undergraduate lab course on software architecture and web technologies, held at the Faculty of Computer Science, University of Vienna.

The lab course was provided in a blended learning mode, with face-to-face lab meetings serving as a plenum for assigning tasks, doing hands-on exercises, discussing contributions, solving task and project related problems, checking assignments, and presenting team project results. The lab course started two weeks into the semester with two-hour face-to-face meetings held (almost) every week thereafter. The student workload for the whole module (lab course plus lecture course) was about 10 hours per week.

Students had to complete a number of individual assignments as well as team-project tasks during the online phases of the lab course. They were also active during in-class exercises, presentations and discussions, but most of the learning activities took place at a distance with the support of a learning management system.

TASK

As one of the lab course instructors, I was always dissatisfied with the fact that I did not really know how students were approaching the assignments and the team project work, or what they experienced during that work (e.g. problems encountered, dead-ends, alternative solutions, decision processes, teamwork issues). This was because most of the work was carried out outside of the computer lab. The computer lab was merely a face-to-face synchronization of individual and team learning paths,