TECHNOLOGY ENHANCED LEARNING

Practical Design Patterns for Teaching and Learning with Technology

Yishay Mor, Harvey Mellar,
Steven Warburton and Niall Winters (Eds.)

SensePublishers

Practical Design Patterns for Teaching and Learning with Technology

TECHNOLOGY ENHANCED LEARNING
Volume 8

Scope
The rapid co-evolution of technology and learning is offering new ways to represent knowledge, new educational practices, and new global communities of learners. Yet the contribution of these changes to formal education is largely unexplored, along with possibilities for deepening our understanding of what and how to learn. Similarly, the convergence of personal technologies offers new opportunities for informal, conversational and situated learning. But this is widening the gulf between everyday learning and formal education, which is struggling to adapt pedagogies and curricula that were established in a pre-digital age.

This series, *Technology Enhanced Learning*, will explore learning futures that incorporate digital technologies in innovative and transformative ways. It will elaborate issues including the design of learning experiences that connect formal and informal contexts; the evolution of learning and technology; new social and cultural contexts for learning with technology; novel questions of design, computational expression, collaboration and intelligence; social exclusion and inclusion in an age of personal and mobile technology; and attempts to broaden practical and theoretical perspectives on cognition, community and epistemology.

The series will be of interest to researchers and students in education and computing, to educational policy makers, and to the general public with an interest in the future of learning with technology.

Practical Design Patterns for Teaching and Learning with Technology

Edited by
Yishay Mor
Harvey Mellar
Steven Warburton
Niall Winters

SENSE PUBLISHERS
ROTTERDAM/BOSTON/TAIPEI

A C.I.P. record for this book is available from the Library of Congress.

ISBN: 978-94-6209-528-1 (paperback)
ISBN: 978-94-6209-529-8 (hardback)
ISBN: 978-94-6209-530-4 (e-book)

Published by: Sense Publishers,
P.O. Box 21858,
3001 AW Rotterdam,
The Netherlands
https://www.sensepublishers.com/

Printed on acid-free paper

TABLE OF CONTENTS

YISHAY MOR, HARVEY MELLAR,
STEVEN WARBURTON, & NIALL WINTERS

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

Y. Mor et al., (Eds.), Practical Design Patterns for Teaching and Learning with Technology, 1–11.

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.

– 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.

REFERENCES

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

Barab, S. A., Baek, E., Schatz, S., Scheckler, R., & Moore, J. (2008). Illuminating the braids of change in a web-supported community. In A. E. Kelly, R. A. Lesh, & J. Y. Baek (Eds.) *Handbook of design research methods in education*. New York: Routledge.

Beetham, H. & Sharpe, R. (2013). *Rethinking pedagogy for a digital age: Designing for 21st century learning*. London: Routledge.

Bergin, J. (2000). Fourteen pedagogical patterns. In M. Devos, & A. Rüping (Eds.) *Proceedings of the 5th European Conference on Pattern Languages of Programs (EuroPLoP '2000), Irsee, Germany, July 5-9, 2000*. Konstanz, Germany: UVK. Retrieved 7 Feb 2013 from
http://hillside.net/europlop/HillsideEurope/Papers/EuroPLoP2000/2000_Bergin_FourteenPedagogicalPatterns.pdf.

Bergin, J., Eckstein, J., Volter, M., Sipos, M., Wallingford, E., Marquardt, K., Chandler, J., Sharp, H, & Manns, M. L. (Eds.) (2012). *Pedagogical patterns: Advice for educators*. New York: Joseph Bergin Software Tools.

Black, P., & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability, 21*(1), 5-31.

Brouns, F., Koper, R., Manderveld, J., van Bruggen, J., Sloep, P., van Rosmalen, P., Tattersall, C., & Vogten, H. (2005). A first exploration of an inductive analysis approach for detecting learning design patterns. *Journal of Interactive Media in Education 2005, 03*. Retrieved February 3, 2013 from http://jime.open.ac.uk/2005/3.

Daly, C.; Pachler, N.; Mor, Y., & Mellar, H. (2010). Exploring formative e-assessment: Using case stories and design patterns. *Assessment & Evaluation in Higher Education, 35*(5), 619 -636.

Derntl, M., & Motschnig-Pitrik, R. (2005). The role of structure, patterns, and people in blended learning. *The Internet and Higher Education, 8*(2), 111-130.

Goodyear, P. (2005). Educational design and networked learning: Patterns, pattern languages and design practice. *Australasian Journal of Educational Technology, 21*(1), 82-101.

Goodyear, P., Avgeriou, P., Baggetun, R., Bartoluzzi, S., Retalis, S., Ronteltap, F., & Rusman, E. (2004). *Towards a pattern language for networked learning*. Paper presented at the Networked learning Conference 2004. Retrieved 6 Feb 2012 from
http://www.networkedlearningconference.org.uk/past/nlc2004/proceedings/individual_papers/goodyear_et_al.htm

Jenkins, H., Clinton, K., Purushotma, R., Robison, A. J., & Weigel, M. (2006). *Confronting the challenges of participatory culture: media education for the 21st Century*. Chicago: The MacArthur Foundation. Retrieved 1 Feb 2013 from
http://digitallearning.macfound.org/atf/cf/%7B7E45C7E0-A3E0-4B89-AC9C-E807E1B0AE4E%7D/JENKINS_WHITE_PAPER.PDF.

Kali, Y. (2006). Collaborative knowledge building using the Design Principles Database. *International Journal of Computer-Supported Collaborative Learning, 1*(2), 187-201.

Kali, Y. (2008). The Design Principles Database as means for promoting design-based research. In A. E. Kelly, R. A. Lesh, & J. Y. Baek (Eds.) *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. Mahwah, NJ: Lawrence Erlbaum Associates.

Laurillard, D. (2012). *Teaching as a design science: Building pedagogical patterns for leaning and technology*. New York: Routledge.

Linn, M. C., Bell, P., & Davis, E. A. (2004). Specific design principles: Elaborating the scaffolded knowledge integration framework. In M. C. Linn, E. A. Davis, & P. Bell (Eds.) *Internet environments for science education*. Mahwah, New Jersey: Lawrence Erlbaum.

Mor, Y. (2010). A design approach to research in technology enhanced mathematics education. Unpublished doctoral thesis, Institute of Education, University of London. Retrieved 6 Feb 2013 from
https://docs.google.com/r?a=v&pid=sites&srcid=eWlzaGF5bW9yLm9yZ3xhY2FkZW1pY3xneDo1NDI0Y2JmODNmN2VkZDRk.

Mor, Y. (2013). SNaP! Re-using, sharing and communicating designs and design knowledge using scenarios, narratives and patterns. In: R. Luckin, P. Goodyear, B. Grabowski, & N. Winters (Eds.) *Handbook of design in educational technology*. London: Routledge,

Mor, Y., & Mogilevsky, O. (2012). *A learning design studio in mobile learning*. Paper presented at 11th World Conference on Mobile and Contextual Learning, Helsinki, (2012). Retrieved 15 Feb 2013 from: http://oro.open.ac.uk/34995/.

Mor, Y., & Winters, N. (2007). Design approaches in technology enhanced learning. *Interactive Learning Environments. 15*(1) 61-75.

Mor, Y., & Winters, N. (2008). Participatory design in open education: a workshop model for developing a pattern language. *Journal of Interactive Media in Education, 2008*(1). Retrieved 3 Feb 2013 from http://jime.open.ac.uk/2008/13.

Mor, Y., Mellar, H., Pachler, N., & Daly, C. (2010). Formative e-assessment: case stories, design patterns and future scenarios. In C. Kohls, & J. Wedekind (Eds.) *Investigations of e-learning patterns: Context factors, problems and solutions*. Hershey, PA: Information Science Publishing.

Mor, Y., Warburton, S., & Winters, N. (2012). Participatory pattern workshops: a methodology for open learning design inquiry. *Research in Learning Technology, 20*. Retrieved 15 Feb 2013 from:
http://www.researchinlearningtechnology.net/index.php/rlt/article/view/19197/html.

Mor, Y., Winters, N., & Warburton, S. (2010). *Participatory Pattern Workshops resource kit*. Retrieved 3 Feb 2012 from http://hal.archives-ouvertes.fr/hal-00593108/.

Retalis, S.; Georgiakakis, P., & Dimitriadis, Y. (2006). Eliciting design patterns for e-learning systems. *Computer Science Education, 16*(2), 105-118.

Warburton, S. (2009). *MUVEnation report: Design patterns for virtual worlds.* Retrieved 18 Dec 2012 from http://dl.dropbox.com/u/4424450/KCL_v6_MUVENATIONDesignPatternsWP4.pdf.

Warburton, S. (Ed.) (2010). *Digital identity matters*. London: King's College London. Retrieved 03 February 2013 from
http://digitaldisruptions.org/rhizome/wp-content/uploads/2010/06/rhiz08_DigitalIdentityMatters.pdf.

Winters, N., & Mor, Y. (2009). Dealing with abstraction: Case study generalisation as a method for eliciting design patterns. *Computers in Human Behavior, 25*(5), 1079-1088.

AFFILIATIONS

Yishay Mor, Harvey Mellar & Niall Winters
London Knowledge Lab
Institute of Education, University of London
UK

Steven Warburton
University of Surrey
UK

DIANA LAURILLARD & MICHAEL DERNTL

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

Y. Mor et al., (Eds.), Practical Design Patterns for Teaching and Learning with Technology, 13–16.

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).

REFERENCES

McCombs, B. L., & Miller, L. (2006). *Learner-centered classroom practices and assessments*. Thousand Oaks, California: Corwin Press.

Rogers, C. R. (1983). *Freedom to learn for the 80's*. Columbus, Ohio: Charles E. Merrill Publishing Company.

AFFILIATIONS

Diana Laurillard
London Knowledge Lab
Institute Of Education, University of London
UK

Michael Derntl
RWTH Aachen University
Aachen
Germany

SONJA KABICHER & RENATE MOTSCHNIG-PITRIK

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.

Y. Mor et al., (Eds.), Practical Design Patterns for Teaching and Learning with Technology, 17–21.

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.

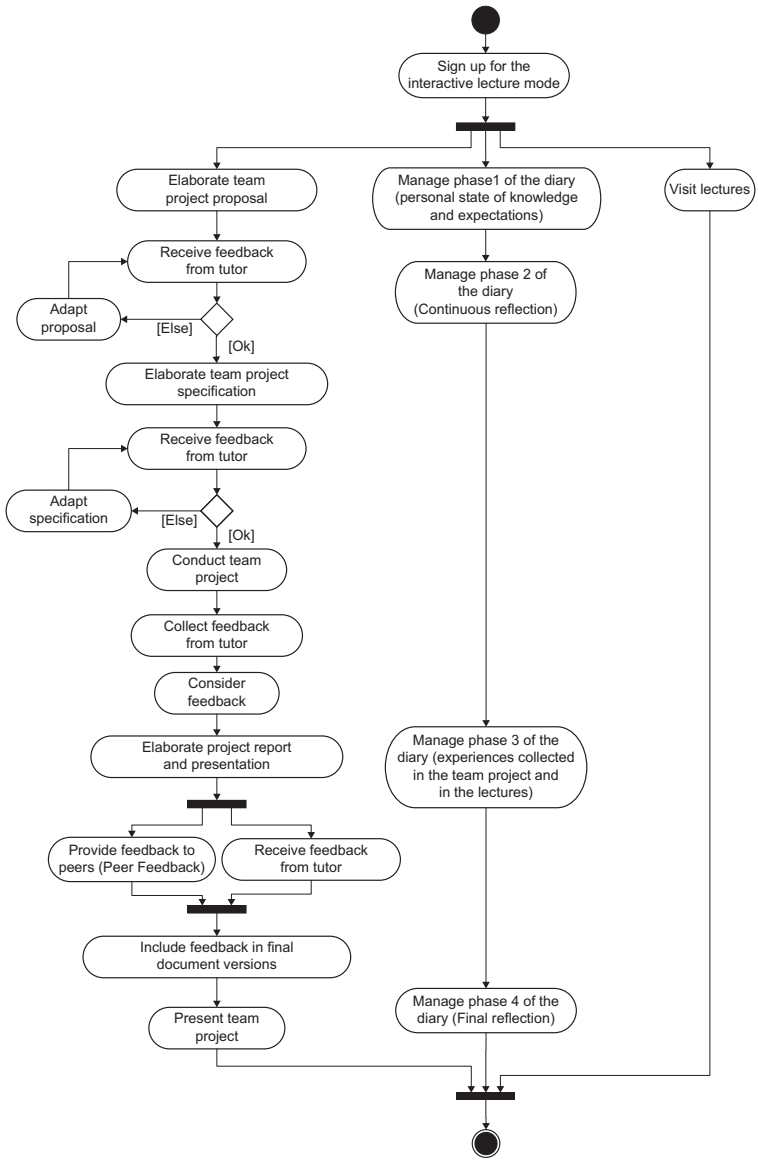

Figure 1. Students' activities of the interactive lecture mode as conducted in the Human-Computer Interaction and Psychology course.

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.

REFERENCES

Kabicher, S., Kriglstein, S., Figl, K., & Motschnig-Pitrik, R. (2008). Using ePortfolios enhancing for learning through computer-mediated interaction in a course on HCI. In A. Holzinger (Ed.) *Lecture Notes in Computer Science,5298, HCI and Usability for Education and Work: 4th Symposium of the Workgroup Human-Computer Interaction and Usability Engineering of the Austrian Computer Society, USAB 2008, Graz, Austria, November 20-21, 2008. Proceedings Series: Lecture Notes in Computer Science, Vol. 5298, Subseries: Programming and Software Engineering.* Berlin: Springer.

Mangler, J., & Derntl, M. (2004). *CEWebS – Cooperative Environment Web Services*. Paper presented at 4th International Conference on Knowledge Management, Graz, Austria. Retrieved 23 Dec 2012 from http://www.researchgate.net/publication/228983514_CEWebS-Cooperative_Environment_Web_Services.

Peterson B., Roemmer-Nossek, B., & Logar, S. (2007). *Using creative writing techniques for ePortfolio work: Writing to enhance your competencies and develop your own voice*. Paper presented at the Conference Lifelong Learning – ePortfolio and Open Content, Katowice, Poland.

AFFILIATIONS

Sonja Kabicher & Renate Motschnig-Pitrik
Faculty of Computer Science
University of Vienna
Austria

MICHAEL DERNTL

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,

Y. Mor et al., (Eds.), Practical Design Patterns for Teaching and Learning with Technology, 23–30.

which were not at all transparent to me. My main problem was that I saw the product of their work, but had no insight into the processes. Occasionally a discussion board posting would shed some light onto particular problems encountered, but this was not a very rich source of insight.

My belief is that the learning process is equally or even more important than the outcome, so I felt a growing dissatisfaction with the situation and felt that I had to do something about it. The aim was to provide students with a means of expressing their meanings, problems, and solutions, while at the same time providing me with a means of 'monitoring' and facilitating their learning activities.

ACTIONS

My idea was to have students document their efforts in contributing online and face-to-face in their personal blog. Blogging was intended as a kind of personal journal: it should offer the students some space for posting insights, reflections and comments on the assignments and tasks (e.g. why they were unable to solve a problem), reflection on their project teamwork, and anything else they may consider worthwhile to mention. I gave them the following piece of guidance for using the blogging tool, both verbally and on the e-learning system:

> Use your blog to reflect on your problems, insights, and contributions during and after your task-related activities (project work, individual tasks) for the lab course. For example, you could ask yourself the following questions: What causes/caused me problems (and why)? Which solutions have I found/tried that could also be useful for my colleagues? Where was I unable to find a solution (and why)? What am I contributing to the team project? How do/did I approach the current problem? The minimum requirement is one blog entry per person per assigned task.

The blogs were hosted on Blogger, a free blog hosting service offered by Google (http://blogger.com/). Thus, the blogs were accessible publicly by everyone on the web. The problem of integrating the blogging activities into the course's learning management system (LMS) was approached by implementing a custom module as an extension to the LMS, which served students and instructors as an entry point to blogging activities. The module produced an LMS page comprising several pieces of information (see screenshot below):

- The blogging guidelines as given above.
- A link to their own blog on Blogger as well as to the instructor's blog. At the beginning of the lab course students were asked to create a personal blog on Blogger and to submit their username to their instructor.
- A bullet list of the 20 most recent blog entries, including title, author, date, and number of comments. This list was automatically updated every three hours by parsing and transforming the RSS feeds available on Blogger for each blog.

– A list of links to all student blogs. It was possible to assign a rating to each blog (1 to 5 stars) right next to the blog link. This rating, and a list of top bloggers, was also listed on the page in the form of top-10 charts. The idea underlying the rating option was to stimulate blogging activity, and to reward frequent and popular bloggers with presence on the blog page.

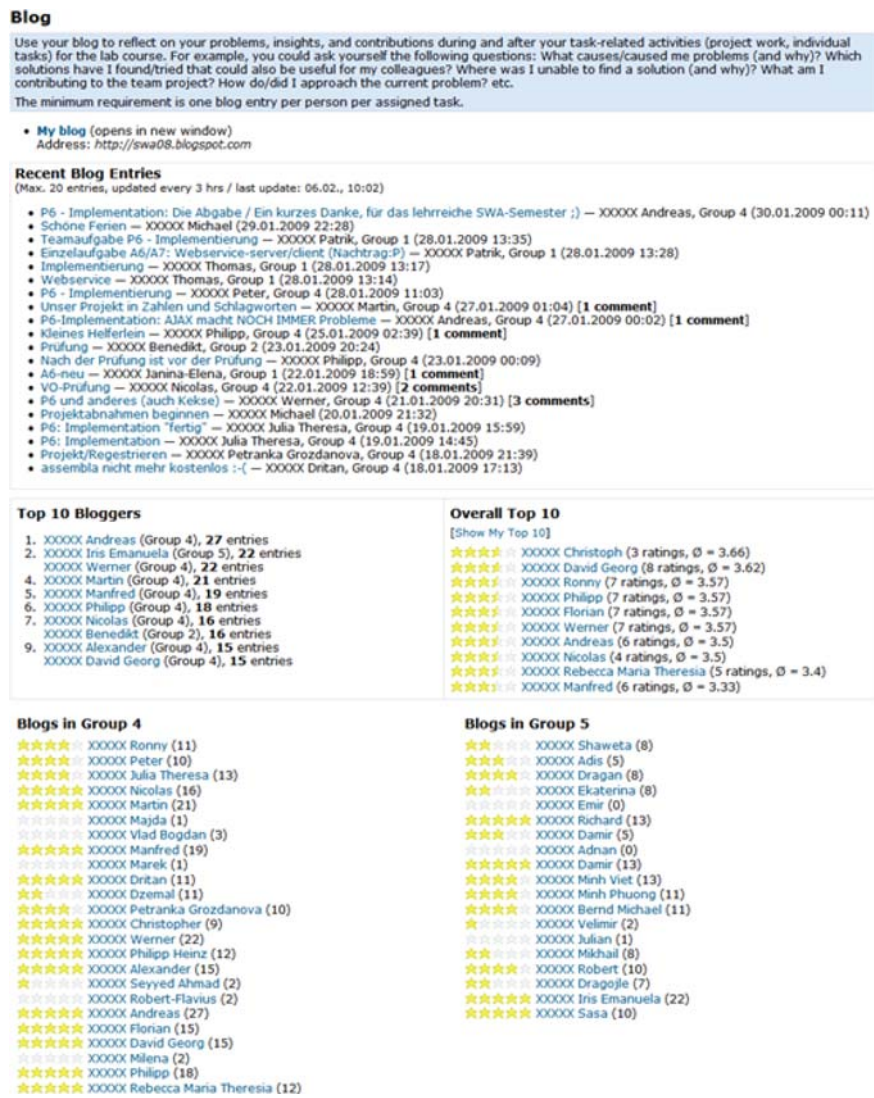

Figure 1. Integrating the blogs in the Learning Management System.

Note that it would have been possible to use any of the freely available RSS feed readers on the web (e.g. Google Reader at that time) as the blog portal, but I wanted to have better control over the appearance and usability of the feeds, and I wanted the feeds to be integrated into our LMS. Blogger was my first choice of blog hosting service because it is one of the most popular and feature-rich services but the blogs could have been hosted on any other blog hosting service that is free of charge.

During the semester, I tried to spark and sustain blogging activities by taking the following support actions:

– First of all, I took some time *every* morning to read *all* new blog entries.
– I regularly updated my instructor blog (http://swa08.blogspot.com/). I tried not to overwhelm student bloggers with my rants, so I figured that about one or two blog entries per week should do it.
– I frequently commented on student blog entries, looking to encourage exploration, compliment good contributions, ask open-ended questions, and encourage peer interaction.
– In the face-to-face lab meetings I frequently referred to issues raised in student blogs. This was intended to help the students to understand that blogging activities do have an effect on face-to-face actions.

RESULTS

To provide some orientation, here are some quick facts about the bloggers:

– I had 43 students in two course groups (the split groups were due to computer lab size restrictions).
– About one-third of the students already had prior experience with keeping a blog, while another 40% of them only had experience with reading other blogs.
– A handful of my students had no idea what a blog actually was.
– Each student posted an average of close to ten blog entries over the whole semester.
– An average entry had slightly more than 800 characters, i.e. the length of a typical text paragraph.
– Almost 250 comments were posted to the course blogosphere.

Given what I wanted to achieve by introducing student blogs, the experience was a great success: engaging in the course blogosphere by reading, commenting and posting was a highly enjoyable experience. Even though some students obviously posted to their blog only to avoid having an empty blog, there were a considerable number of students who did seize the opportunity of being able to voice their problems, solutions, thoughts and insights:

– Informal learning communities emerged through groups of students frequently posting comments to their peers' blogs to support each other, and also to engage in off-topic conversations.

– The blogs offered rich sources of insight into student learning processes. Students frequently reported in detail on how they tried to solve the given assignments, describing the problems they encountered, explaining and sometimes 'showing off' the solutions they came up with, but also the struggles with teammates, deadlines, and other courses.
– The issues raised in the blogs helped me identify frequently occurring obstacles encountered during assignments before those assignments were due to be discussed and presented in class. This proved to be valuable input to upcoming face-to-face lab meetings.
– The students used all sorts of fancy gadgets offered by Blogger, e.g. widgets that enable embedding to-do lists, friend lists, personal information, and web bookmarks, into their blog page.

Figure 2 shows a screenshot of one of the student blogs. The example blog entry that is shown deals with problems in finding the 'right' level of abstraction when modelling the architecture and design of a piece of software to be built. Brief and simple entries like this one helped me greatly by revealing specific problems the students had when solving their assignments. Also, the brief comment I left there might have helped other students to see that it is not only the solution that counts, but that I value the path to the solution as well.

LESSONS LEARNED

Insights into learning processes

The blogs offered valuable, sometimes unexpected, insights into how students approach and perceive the tasks given to them and on the distribution of work amongst members of a team. I was able to draw different kinds of insights, e.g.:

– Ups and downs during working in a team.
– From journal-like postings on time spent on and problems encountered during assignments, I was able to gain insight into the amount of time and work required for solving the problems.
– Bloggers who posted solutions to unexpected problems that they encountered during their tasks and the resources they discovered on the web during their search for solutions provided hints to the most difficult stages in the problem-solving processes for them. Consequently, I was able to dedicate some time to addressing these issues in subsequent lab meetings.
– The process of creating a solution should be considered with equal weight to the outcome; but it often turns out to be difficult to estimate the effort a student puts into finding a solution or remedy by assessing the outcome only. Blog entries explaining problems, failures, and solutions offer valuable complementary information related to the learning process.

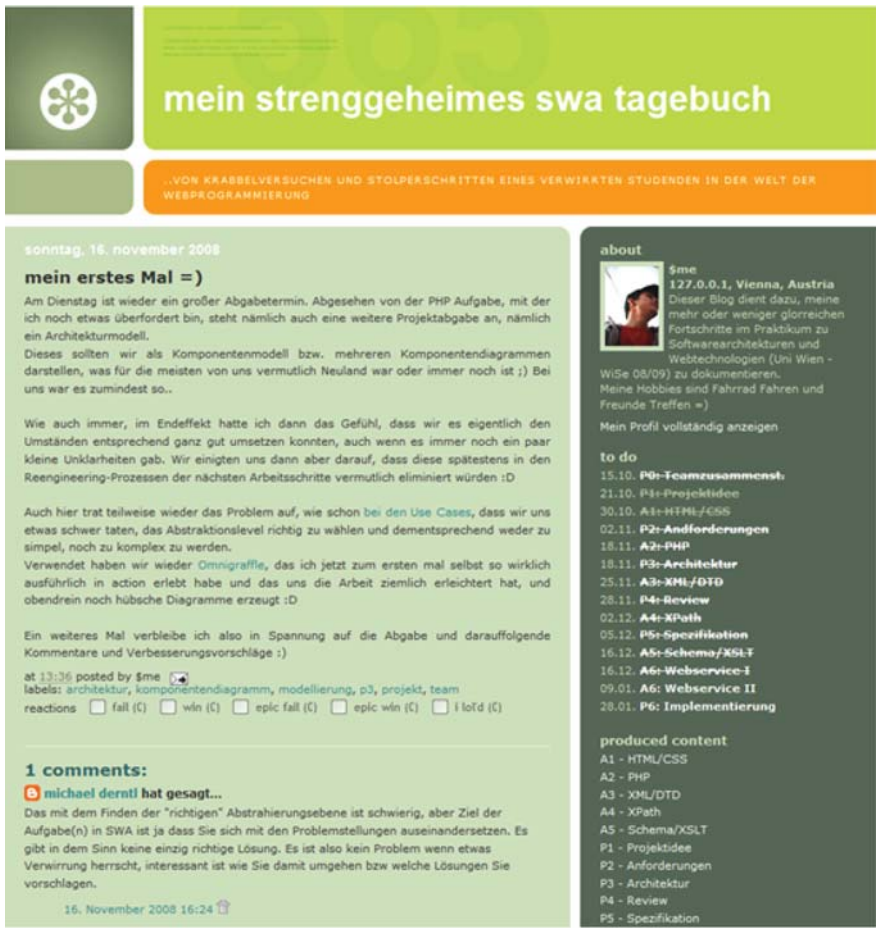

Figure 2. A student blog.

Increased responsibility

Introducing student blogs essentially adds a new communication channel for student-student and student-instructor communication; thus it also adds to the overall responsibility of the instructor. For instance, on one occasion I ran into trouble with a student who complained about his dissatisfaction with my written comments on one of his assignments. This was included in a larger blog entry, and obviously I read over that entry too quickly and missed the complaint. The motivation and the scores of this student visibly dropped in the following weeks, and I had no idea why this was the case. The issue was resolved only in one of the final lab meetings, where I eventually brought up the concern.

Increased workload

Introducing student blogs also involves additional workload for the instructor. On some days it took an unexpectedly high amount of time to read the blogs, ponder their meanings, and offer support to solve the issues raised. Blogging activity generally followed a quite ragged pattern, i.e. on some days the student community posted less than five blog entries, while on some days they fired more than thirty entries into the course blogosphere. Unfortunately, those peak days were typically located close to upcoming lab meetings, where I had to prepare the meetings and check the assignments. So I had to adapt my weekly routine by reserving a couple of hours before each lab meeting to deal with unexpected issues emerging from the blogs. Note that having the support of a tutor would be very helpful here.

Communicating blogging requirements

From feedback and discussions during the first face-to-face meetings, I discovered that students were initially not sure what content they were 'supposed' to post to their blogs, so I sought to explain and clarify my requirements and expectations on multiple occasions, particularly during the first couple of weeks.

Motivating bloggers

While some students seemed to have an intrinsic motivation and enjoyed experimenting with blogs, others seemed less eager to use this tool. Telling those reluctant students to contribute more to the blogosphere was not really successful: the blog entries they posted after being 'pushed' to blog often did not include any meaningful information or contribution. However, the vast majority of my students were open and positive about this novel experience.

REFERENCES

More details about studies in two different years, along with specific research questions and findings, can be found in the following publications:

Derntl, M. (2008). Employing student blogs as reflective diaries in a lab course. In D. G. Kinshuk, J. Sampson, M. Spector, P. Isaias, & D. Ifenthaler (Eds.), *Proceedings of the IADIS international conference on cognition and exploratory learning in the digital age*. Freiburg, Germany.

Derntl, M. (2009). Understanding and facilitating student bloggers: Towards a blogging activity model. *Lecture Notes in Computer Science, 5686*, 140–149.

Derntl, M., & Graf, S. (2009). Impact of learning styles on student blogging behavior. In *Proceedings 9th IEEE International Conference on Advanced Learning Technologies*. Riga, Latvia: IEEE.

Derntl, M., & Mazzurana, T. (2010). Case study on student blogs in a blended learning course. In J. M. Spector, D. Ifenthaler, P. Isaias, Kinshuk, & D. G. Sampson (Eds.), *Learning and instruction in the digital age*. New York: Springer.

AFFILIATION

Michael Derntl
RWTH Aachen University
Aachen
Germany

JUDY ROBERTSON

1.1.3 DESIGN NARRATIVE: STAR OF THE WEEK

SUMMARY

This design narrative is about motivating first year students by showcasing good student work every week to the class.

SITUATION

A large class (138) of first and second year computer science students on a programming module called Interactive Systems. The students' assignment was to create a virtual pet in Second Life. This involves 3D modelling and programming skills.

TASK

The general problem is how to engage first year students: to motivate them with their learning and encourage them to continue with their studies when they find it difficult. The intended effect was to engage and motivate the students, by showing examples of good work which others could learn from, and showing students their work is valued, and also to build a sense of community.

ACTIONS

The approach was to introduce Creature of the Week (this could be generalised to Star of the Week for other projects). This means that I select a virtual pet from the Second Life island every week, take a screen shot of it, and then display that screenshot at the start of every lecture. It also goes on the class blog in the VLE for the module. Sometimes there are runner-up creatures. Sometimes I do a live demo of the creatures in SL to show interactive behaviour. Sometimes I pick creatures which display particular techniques we have been learning about. Sometimes I just pick them because they appeal to me.

In a similar vein, there was a Virtual Crufts at the end of semester where peer nominated creatures got prizes. This is based on previous modules I have taught where we have had Multimedia Oscar ceremonies.

Y. Mor et al., (Eds.), Practical Design Patterns for Teaching and Learning with Technology, 31–33.

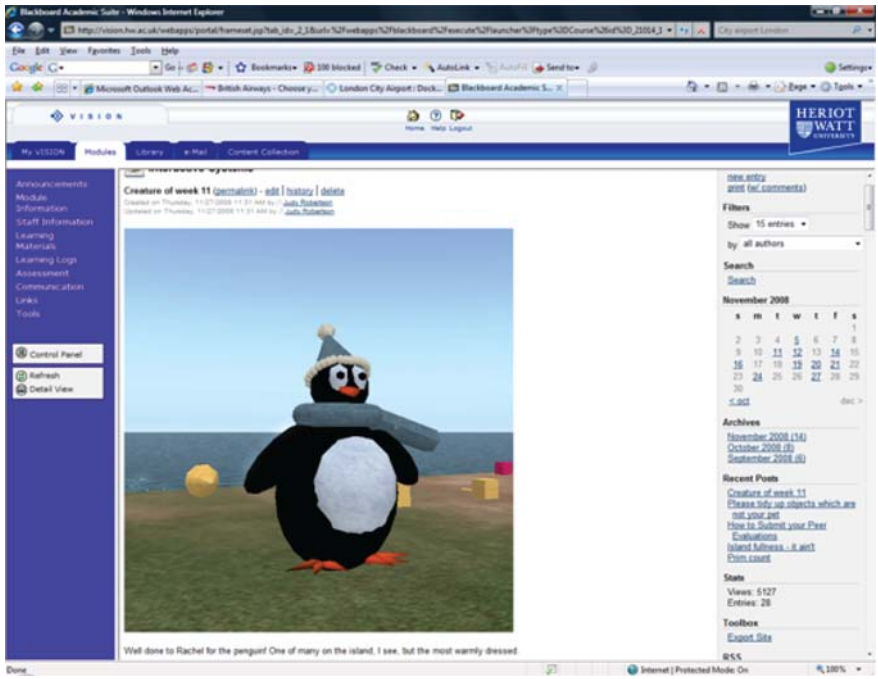

Figure 1. A Creature of the Week.

RESULTS

It is quite hard to measure the impact of this alone, but it seems to be well received. The lecture audience seem to like seeing the creatures, and the owner of the creature often looks sheepishly proud. Sometimes students tell me someone's pet should be Creature of the Week; sometimes they tell me theirs should be Creature of the Week. They also often point out good examples they have seen which have not been showcased. Some of the students wrote in their learning logs about being inspired by seeing other students' work and how they aimed to do as well. One student said he didn't like Creature of the Week because he thought it was 'demeaning' for students who weren't picked. 'Demoralising' is perhaps a better word. A result which should not be discounted: I like doing it. It's fun. Lecturers need to have positive experiences just as much as their students!

LESSONS LEARNED

I might do this more systematically next year, trying to show more examples of good technical work. But I think it is a reasonable, light weight, way of trying to create a fun class community. It works because the assignment is about something

visual, and because the project is ongoing for 12 weeks. You might get occasional students who have social difficulties which mean they really hate to have their work publically displayed. It might be a good idea to mention you are going to do Star or the Week at the start of semester and let anyone who is horrified by the notion approach you then.

AFFILIATION

Judy Robertson
Heriot-Watt University
UK

RENATE MOTSCHNIG-PITRIK

1.1.4 DESIGN NARRATIVE: ESTABLISHING A CONSTRUCTIVE ATMOSPHERE IN CLASS IN WHICH CREATIVITY AND COOPERATION ARE WELCOME

SUMMARY

An initial challenge in courses that aim at rich learning from interaction is to establish a constructive atmosphere in class. One step in this process is to include students in their learning, for example by fine-tuning the learning outcomes based on students' expectations or by respecting the students' feedback on course units in the design of follow-up units. A simple but powerful tool for student inclusion is reaction sheets, submitted online, read by the cohort and discussed in class. If the multiple perspectives are addressed and honoured, students tend to open up and benefit from sharing.

SITUATION

The courses are held in a blended learning mode. They have the following (or similar) learning goals among their generic learning objectives:

- Participants acquire personal experience, skills, and develop facilitative interpersonal attitudes in situations of professional and everyday communication (such as listening, articulating, speaking in a group, conflict resolution, decision making).
- Participants build a learning community around the course's subject matter including a concern for better communication and understanding.
- Participants experience active listening and develop their own attitude towards it, become more sensitive and open to their own experience and loosen preconceived, rigidly held constructs.
- Participants move from more stereotyped behaviour and facades to more personal expressiveness and better understanding of themselves and others.
  (The term 'participants' here is intended to include both students and facilitators.)

TASK

Motivation

A major task is to motivate students to share their thoughts, feelings, meanings, concerns, etc. in an open but equally constructive and valuing way. A precondition

Y. Mor et al., (Eds.), Practical Design Patterns for Teaching and Learning with Technology, 35–40.

is to establish a safe and facilitative climate in class and to be able to 'listen to the students' voices'. If this is accomplished it is more likely that instruction or facilitation can be done in a way that is most suitable for the concrete community of learners under the particular given circumstances.

Expressing personal reactions

In courses in which individual units are organized as a series of workshops of three hours or more, students are encouraged to cooperate actively on small tasks and afterwards to share their reactions with the facilitator and with peers. The purpose of sharing reactions is manifold: students are encouraged to reflect on their learning experience and at the same they learn to express their perceptions and thoughts in a written form. Subsequently, they get the possibility to read their colleagues' reaction and through that broaden their perspectives. They may, for example, read that while they were bored by a particular exercise their colleagues considered this same exercise as a rich source for learning. For facilitators, students' reactions can provide an honest response to the questions: 'Where am I with this particular class and how does every participant perceive the course? Is there anything that needs clarification? What is the best way to move on from where we are?'

ACTIONS

Format and process

The reactions are collected as online reaction sheets in a free form, introduced by a sentence like: 'Please share your reaction to the previous workshop, in particular, what you liked, what you did not like such that it could be improved, and what you think you take with you from the workshop.' The reaction sheets are visible to all course participants and the instructor. Students are asked to first write their reaction before reading others' reactions. This is to allow them to exploit the unique opportunity of new media, namely to share independently – without being influenced by those who voiced their opinions before one's turn. Importantly, I want to emphasize an essential issue on which the successes of reactions sheets as highly potent instrument depends: honest and open communication needs to be established in the face-to-face workshops if its appearance is sought in the written reactions. They act as mirrors of the educational process and as an educator one needs some courage to look into that mirror, since the picture it reflects becomes part of the educational process.

Introducing reaction sheets

In the first workshop, the offer of working with reaction sheets and their meaning and potential effect on follow-up course units is discussed with students and it is

explained that non-anonymous reactions are preferred so that the reaction sheets can be discussed directly in face-to-face sessions and furthermore counted as active participation amenable to consideration in the grade.

Reading and feedback

I read the reactions with much interest and excitement, discovering how students perceived the workshop unit and how this compares with my own perception. The reaction sheets are then discussed with students in the face-to-face workshops and tend to have direct effects on the workshops. For example, breaks are extended if students complain that they were too short, or the amount of exercises or explanations is increased or reduced, based on the students' feedback. Some students report they are equally interested in the reactions of their peers and, almost as a rule, the most essential learning is that students' perceptions are different. In this respect, the reaction sheets convey the different perceptions and make multiple perspective-taking explicit. They also reflect how creative solutions to authentic problems in class emerge from listening to, and mutually respecting, each other. Let us illustrate this by following three excerpts from online reaction sheets written by students participating in a course on communication and soft skills held at the Faculty of Informatics of the Masaryk University in Brno, Czech Republic. The first two excerpts were written in response to the initial course block, the third one stems from the second block.

Examples

Jana (names have been changed to preserve anonymity) writes: 'I liked the way that first block was conceived. There was a lot of discussion, but there was also theory and we played games. I expected that the whole block would be in English and I would be very hard for me to speak in English. But we discussed the topic English vs. Czech language and agreed that we try to speak in English if it would be possible, but complicated topics would be discussed in Czech. After listening to arguments, why one person wants to speak in English and on the contrary another wants to discuss complicated topics in Czech, it was easier to accept the agreement for me than if the teacher had said it without discussing it.'

Peter was open towards sharing a critical remark: 'The only issue in which I see a potential for improvement is the dynamics in discussions. Some time consuming interplays [...] were unnecessarily long. I do not know exactly how to avoid that – the only thing that comes to my mind is a larger degree of control during discussions from the side of the instructor.'

Clearly, what was appreciated by Jana, namely sharing views and discussing options, seemed like a waste of time for Peter, who wanted to get 'to the core' faster and have the facilitator exercise more control. Interestingly, although these different viewpoints were not explicitly discussed in class, in the next unit something

changed: all participants (students as well as the facilitator) were aware of the danger of discussions becoming too unwieldy and cooperated to create a better balance between discussion and topic work. This change was perceived by a number of students, including by Peter who had shared the critical remark on the dynamics of discussions after the first block. He wrote: 'In my first evaluation I mentioned that some progress still would be achievable in upcoming discussions in which the whole group participates. In the second meeting I have not observed any insufficiencies anymore and for myself I must say that I highly enjoyed all group discussions, whether in the role of 'just' a listener or that of an active participant.'

Changes occurring without planned action

Interestingly, some actions and consequent changes in the course happened through sharing observations and feelings in the reaction sheets, *without* any further controlled or even explicitly promoted action! They seem to evolve implicitly and to some degree be expressed and enacted by collective behaviour of the group. As an example consider Peter's observations as described in the Section on Examples: it seems that by voicing that he felt uncomfortable with discussions becoming too unwieldy, several others watched out for this phenomenon. In this way it could be overcome by common effort (and related experiential learning by all) rather than the instructor playing the judge to cut discussions off whenever she felt they were becoming too long.

RESULTS

Extended reflective experience by combining written and oral expression

The examples given above also illustrate the power of *mixing* or *blending* face-to-face and written online expression. By writing and reading the reactions in a peaceful moment between the course blocks, students had time to think about and feel how course elements and others' perceptions resonated with them such that they could let their own thoughts and reactions emerge and ripen for some time. Furthermore, working towards creative solutions at course level is likely to inspire students to work more creatively at the team and individual level. Despite lacking scientific proof for that, the students' outcomes from the courses tended to be clearly above average, as was sometimes observed by students in their reactions, peer and self evaluations.

Creativity

Reaction sheets include students as participants in the design of their courses. Producing these reaction sheets tends to become a creative process, involving all participants under the coordination and moderation of the instructor. In this way,

collection of ideas and perceptions is increased and juggling with course elements is encouraged, with the goal of bringing out the essence for the most meaningful learning. The reaction sheets foster creativity in leaving the locus of evaluation with the student, in encouraging freedom of expression, in that on the web everyone has equal opportunities to express themselves, irrespective of, for example, having a soft voice or being shy and thus being more likely to be overlooked in class.

Students tend to feel 'heard'.

In order to appreciate the use of reaction sheets, let us illustrate it by two more examples:

While reflecting on a course unit of a course on 'Person-Centered Communication', a student wrote: 'I liked the fact that we discussed the reaction sheets in the beginning of the course unit. This way it was possible to have a smooth transition into the next course unit. This, I must say, went very well in the last workshop.'

Another student noted: 'In the beginning of the unit we discussed the reactions. I found this quite good, because on this basis one can see that they are being considered seriously and are respected.'

LESSONS LEARNED

Transparency valued more than anonymity

Anonymous reaction sheets proved to be less useful. The facilitator and peers cannot refer back directly to the student who voiced a particular concern. Also, with anonymous reactions it is not possible to include the student's online cooperation as expressed by submitting reaction sheets into the student's grade.

Need to attend to (some) reactions

If reaction sheets are not addressed in the follow up unit, at least briefly, then students lose motivation to submit them.

Don't justify yourself too much

If criticism is voiced, it is advisable for the facilitator to accept it and not to justify himself or herself and to try to prove the opposite. This would constrain students' freedom of expression and make the whole enterprise an artificial exercise without real sparkling life.

Social interactions need time

It has proved fruitful to provide, within the course units, a climate of psychological safety and to allocate time for social interaction while discussing the reactions. In

this way, when bringing together the written expressions with the spoken words a richer repertoire of ideas for juggling and combining can be assembled and used to flow into the design of the follow up units. In the words of a student: 'I have hardly ever experienced a course in which the next unit started from where the last one ended.'

Summarizing, the web-enhanced reaction sheet offers feedback potentials that optimally complement discussion and dialog in class. Web technology provides valuable assistance in collecting and preparing reactions and comments, which would be almost impossible without technological support. The educator's way of introducing and employing reaction sheets (as well as, to a lesser degree, the students' talents in expressing themselves) largely determines the degree to which this simple but powerful concept turns out to be effective in contributing to significant learning.

AFFILIATION

Renate Motschnig-Pitrik
Faculty of Computer Science
University of Vienna
Austria

DAI FEI YANG & PETER GOODYEAR

1.1.5 DESIGN NARRATIVE: A GENRE-BASED APPROACH TO THE DEVELOPMENT OF ACADEMIC WRITING SKILLS

SUMMARY

This chapter addresses first year students' language difficulties in academic writing at University. The setting for the design narrative is an Object-Oriented Software Development program. Within the genre theoretical framework, it illustrates how an academic literacy program was developed to address language issues with detailed discussion of learning difficulties, module design with specific content examples as well as the discussion of program outcomes and lessons learned. This design narrative has contributed to the knowledge of academic literacy development with a genre-based approach.

INTRODUCTION

This design narrative addresses the task of providing academic literacy support to university students. It concerns the language problems of first year university students in their written assignments. A genre-based approach was developed to help students understand the different text types of their assignments and the language features deployed by experienced writers in effective written communication.

It is very important to be aware that although the example used for this chapter is how to write a use case in Computer Science, it provides a typical example and provides an insight into the language difficulties among first year university students and is therefore valuable to most language educators. In a broader sense, the 'Situation and Lessons Learned' represent many similarities in the university context, while the 'Task and Actions' are designed to capture the core which is flexible and can be adapted to suit similar situations for different disciplinary circumstances in language literacy development.

SITUATION

The support for academic literacy development is essential for first year university students. An embedded language development program (LD) was designed by the Student Learning Unit (SLU) to help students improve their written assignments. In

Y. Mor et al., (Eds.), Practical Design Patterns for Teaching and Learning with Technology, 41–47.

this case, the program was targeted at computer science students who had to write a use case as a part of their written assignment.

A use case is a collection of possible sequences of interactions between the system and its users (or actors). It consists of unambiguous descriptions and a step by step text format to allow a computerised system to translate the user's needs to achieve a desired goal, for example, race nomination acceptance for a Regatta (Box & Ferguson, 2002).

According to the comments made by lecturers, students, in particular international and other students who are non-native English writers/speakers, do not recognise the specific language genre (the staging) for writing a use case. In their writing they tend to make grammatical errors in tenses and write long and redundant sentences in their descriptions. These errors often result in misinterpretation and confusion of the sequence of interactions and consequently the computer system often fails to process the outcomes to achieve the desired goals.

The Student Learning Unit received a request from the unit coordinator to design and teach a language development program to address these writing difficulties. The task is to teach students how to write a well structured and articulated use case.

TASK

After many discussions with the course coordinator, a special language development program was designed and taught in conjunction with the Object Orientated Software Development lecturer in class.

Within the Systemic Functional Linguistics (SFL) framework (Halliday, 1993, 1994; Hassan, 1996; Lemke, 1989; Martin, 1993, 2000), the program was based on Genre theory (Martin, 2000, 2001; Swales 1990; Unsworth 2001). The program specifically focussed on:

- the understanding of language used in a social context
- text type and textual structure
- language features of descriptive and procedural texts
- grammar and sentence structure.

The aim was to provide students with an opportunity to practise language skills within the context of their discipline. Exemplars of well written use cases were used to illustrate the main ideas and specific language functions. Students learn to develop their writing skills through understanding, modelling and meaningful feedback.

ACTIONS

An embedded academic literacy program was developed to support students, in this case, students in the School of Computer Science, in writing a discipline specific discourse. As a part of the Object Orientated Software Development course, students were required to write a use case for their first assignment.

Genre theory formed the theoretical framework for the design of this program. It was used to identify the social context and purposes of a use case, its text type, textual structure and distinctive language features.

The program consisted of four modules. Each module was taught for half an hour in class time in conjunction with the course lecturer. All students were required to attend the language development program.

Module One introduced the concept of language function and social context. A discussion task was developed to help students talk about the social context and purpose of a use case. For example, group discussion included the following questions:

– What is a use case?
– Why do we need to write a use case?
– Who will read and use a use case?
– How does a use case work?

The understanding of the contextualisation of a use case helped students clarify the users' needs and situations in order to produce the sequence of interactions for the computation of desired outcomes.

Module Two introduced the concept of genre (text types) of different written assignments, for example, an essay, a report, a descriptive and a procedural text. A use case is a combination of descriptive and procedural texts. Different text has a different schematic structure and specific language features. For example, an essay has an introduction, body and conclusion. It is dominated by present tense and third person perspective (e.g. Brown suggests such and such). On the other hand, a report has an introduction, aims, method, results, discussion and recommendations. It has present tense (introduction), past tense (method section) and may use future tense for future improvement or recommendations. In a use case, there is a description and list of step by step instructions. When describing the social context and situation of a use case, distinctive use of present tense is evident. However, when writing the sequence of interactions for computation, imperative sentences are to be used. Students need to follow this textual structure and language features in their writing for this assignment.

The awareness of schematic structure and language features deployed by different text types enhances students' repertoire in the appreciation of the effective use of language choices in academic writing.

Exercises in Module Two consisted of selected model texts of different text types. Students were required to identify the different staging and language features appearing in the model texts. These activities were suitable for both group and individual work.

Module Three focused on grammar and sentence structures.

At university level, students are expected to use a variety of simple, compound and complex sentences correctly in their written assignments. In this module, selected sample texts were used for students to identify different sentence types. Students

were also given tasks to identify a noun, a verb, an adjective, an adverb, passive and active forms of verbs, etc. Separate worksheets were used for students to practise writing correct sentences with key words provided.

The grammar session focused on the correct use of single and plural nouns (e.g. nomination and nominations); noun groups (e.g. a regatta race, a nomination form); and third person present tense (e.g. the committee receives nominations in December). Different worksheets were developed to practise correct use of grammar, for example: filling in blanks by selecting the correct words from a list using multiple choice, and asking students to correct grammatical errors in texts written by previous students.

Module Four required students to combine all the knowledge learned in the three previous modules. They were given a situation to write a use case. This activity was done in class and the lecturer was able to provide instant feedback on the students' writing.

In addition to the design of the language development program, a design pattern based on Alexander's pattern languages (Alexander et al., 1977) was developed to capture this academic literacy support experience. It addressed the writing process, language features and genre approach to academic writing. The pattern was written in simple English with non-technical jargon. The pattern captured the principles of the genre theory and how it can be applied to help students develop language skills using the writing of a use case as an example. It also captured the linguistic experience and knowledge of how to construct a well structured and articulated use case. This pattern (ACADEMIC WRITING SKILLS) is presented in 1.2.5.

RESULTS

The embedded literacy program was conducted on three major campuses. One of the authors was a key Student Learning Unit lecturer at one of the campuses. There were about 30 students in the class. They were all first year students, approximately half being international and other students who are non-native English writers/ speakers.

The genre approach to support discipline specific academic writing was effective. Students were able to contextualise their writing within their unit of study. In addition, example texts selected from texts written by previous students were relevant. This enabled students to make a connection between the errors in the sample texts and their own writing and helped to raise their awareness of common language errors in academic writings. Students also appreciated the opportunity to practise in class with constructive feedback on their work from either their peers or the SLU lecturer in class.

Through class observations, students gained confidence in their writing via group discussion and in class practice. Learning was achieved via understanding, group interaction, modelling, critique and individual practice. When marking students'

writing, it was noted that there was an improvement in their textual sequence and sentence structures. As a result, their use cases were written with a better structure and their descriptions of the users' needs were clearer and well articulated.

The genre-based approach to support academic writing in a specific discipline was presented at the 2004 Australian Society for Computers in Learning in Tertiary Education conference. Feedback from the audience on this approach to academic literacy support was well received and positive.

LESSONS LEARNED

Program design: The key challenge of the genre-based approach was that it required the designer to have pre-knowledge of the genre theoretical framework. In addition, the program designer needed to be familiar with different academic texts to be able to draw on specific examples to illustrate linguistic resources used by experienced writers. The designing process also required the meta-language to explain why and how language choices were made to achieve different social purposes in different text types. This should be explained in non-technical linguistic terms. While the curriculum designer had experience in designing language academic literacy programs, her knowledge of writing a use case was very limited. She borrowed two text books from the unit coordinator and attended the Object Orientated Software development lectures. This enabled her to use examples of computer text books and written assignments by previous students and to embed them in the program.

Teaching in class: In the beginning, when the students were told that they would have an embedded literacy program in their subject, there was some rejection from them. They felt they were there to learn computer programming, not to learn how to write.

Strong support from the unit coordinator and course lecturer was important in the beginning. When the students realised that their language skills would enhance the quality of their use case and communication skills with clients and project managers they started to show interest in the literacy program. It was very interesting to observe that even the course lecturer was very impressed with the concept of genre and how it was effectively used in supporting students' academic writing. He mentioned twice that even he had learned something new from the program. He said he would be able to explain to the students their writing problems by using some of the examples.

Learning outcomes: Academic literacy development is a process. For some students, in particular, students who are non-native English speakers, even though they gained confidence in writing a use case, there is a requirement for on-going support for their academic literacy skills. For some students who had problems in writing correct sentences with multiple grammatical difficulties the best solution was to give individual help through at least one to two semesters to overcome these

language difficulties. In this case it was not possible to provide such support. Online support could provide an alternative in such situations. Students were referred to various online literacy programs. The unit coordinator also made the modules and lecture PowerPoint presentations available online.

Collaboration: Conducting embedded literacy programs in Schools requires close collaboration between the unit coordinator, the SLU literacy designer and lecturer and the course lecturer. Such teamwork is rewarding and provides an opportunity to work collaboratively to enhance students' learning experience and improve learning outcomes.

REFERENCES

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.

Box, I, & Ferguson, J. (2002). *Object oriented software development: Step by step.* Sydney: Pearson Education Australia.

Goodyear, P., & Yang, D. F. (2008). Patterns and pattern languages: Supporting understanding and performance in educational design. In L. Lockyer, S. Bennett, S. Agostinho, & B. Harper (Eds.), *Handbook of research on learning design and learning objects: Issues, applications and technologies.*

Halliday, M. A. K. (1993). Some grammatical problems in scientific English. In M. A. K. Halliday, & J. R. Martin (Eds.), *Writing science: Literacy and discursive power*. London: Falmer Press.

Halliday, M. A. K. (1994). *An introduction to functional grammar*. London: Edward Arnold.

Hasan, R. (1996). Speech genre, semiotic mediation and the development of higher mental functions. In D. Cloran, D. Butt, & G. Williams (Eds.), *Ways of saying: Ways of meaning; Selected papers of Ruqaiya Hasan*. London: Cassell.

Lemke, J. (1989). *Talking science: Language, learning and values*. New Jersey: Ablex.

Martin, J. R. (1993). Genre and literacy: Modelling context in educational linguistics. *Annual Review of Applied Linguistics*, *13*, 141–172.

Martin, J. R. (2000). Grammar meets genre: Reflections on the Sydney School. *Inaugural lecture, Sydney University Arts Association*. Retrieved December 23, 2012, from http://openjournals.library.usyd.edu.au/index.php/ART/article/viewFile/5596/6265

Martin, J. R. (2001). Language, register and genre. In A. Burns & C. Coffin (Eds.), *Analysing English in a global context*. London: Routledge.

Martin, J. R., & Rose, D. (2003). *Working with discourse: Meaning beyond the clause*. London: Continuum.

Swales, J. (1990). *Genre analysis: English in academic and research settings*. Cambridge: Cambridge University Press.

Unsworth, L. (2001). Evaluating the language of different types of explanations in junior high school science texts. *International Journal of Science Education*, *23*(6), 585–609.

Yang, D. F. (2008). *Improving networked learning in higher education: Language functions and design patterns.* Unpublished doctoral thesis, University of Sydney. Retrieved December 20, 2012, from http://opac.library.usyd.edu.au/record=b3533325

Yang, D. F. (2010). Design patterns: A connection between systemic functional linguistics and pattern languages. In P. Goodyear & S. Retalis (Eds.), *E-learning, design patterns and pattern languages*. Rotterdam: SensePublishers.

Yang, D. F., & Goodyear, P. (2004). Pattern languages and genres for writing computer science discourse. In R. Atkinson, C. McBeath, D. Jonas-Dwyer, & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference.* Perth, Australia.

AFFILIATIONS

Dai Fei Yang
Student Learning Unit, Academic and Research Division
University of Western Sydney

Peter Goodyear
Faculty of Education and Social Work
University of Sydney

MICHELE CERULLI

1.1.6 DESIGN NARRATIVE: CONTENT MORPH

SUMMARY

Researchers in a European project implemented an effective educational game concerning the study of sequences and wanted to develop a similar game concerning probability and the concept of randomness. This work was developed during the projects Weblabs (http://www.lkl.ac.uk/kscope/weblabs/) and Learning Patterns (http://lp.noe-kaleidoscope.org/).

SITUATION

Within the context of the Weblabs project a game was developed called 'Guess my Robot' (http://lp.noe-kaleidoscope.org/workspace/cases/guessmyrobot/) based on the ToonTalk software (http://www.toontalk.com/). ToonTalk is a programming environment designed for educational purposes where users "train" robots to perform tasks such as producing number sequences, and to collect a finite number of elements of the produced sequence in a container (called Box) that can be sent, via the internet, to other users of the software. A user receiving the box can look at the sequence of numbers and try to guess how the sequence was produced, he/she can then try to program a robot to produce the same sequence and send the robot as a response to the challenge. The first user receives the new robot and compares the sequence of numbers it produces with the sequence of numbers produced by his/her own robot. Following this idea in Weblabs a game was set up where pupils challenged other pupils to guess their own robots. This was very successful in stimulating pupils to reflect and to discuss concepts such as equivalence between number sequences, and different procedures that may produce the same sequence.

Within the same project the research team at the Istituto per le Tecnologie Didattiche (ITD) in Geneva was focusing on probability and randomness. Pupils were introduced to probability and randomness which was addressed through a sequence of activities based on LEGO robots serving as practical experiences on which to build the concept of probability. The researchers interpreted probability as theory concerning random events, and thus believed it was necessary for pupils to move away from the tangibility of LEGO robots toward a semiotic system closer to the mathematical one which could serve as a bridge towards the development of a mathematical theory of probability. ToonTalk could serve as such a semiotic system, being at the same time both playful and mathematical.

Y. Mor et al., (Eds.), Practical Design Patterns for Teaching and Learning with Technology, 49–53.

TASK

To develop a game similar to 'Guess my Robot' which could be used to introduce students to probability.

ACTIONS

Three main kinds of action were carried out:

- A discussion/study of the 'Guess my Robot' experience aimed at finding the key elements of the game which were effective from an educational point of view with respect to the addressed mathematical contents: this was done both by retrieving relevant information from the team that performed the activity (both oral presentation and written reports) and by means of ITD teams' brainstorming like meetings.
- A historical/epistemological study of the new mathematical content, namely probability, aimed at identifying key aspects of the content to be addressed by means of the new game: this was done by reviewing relevant literature and by means of ITD teams' brainstorming like meetings.
- A comparison of the results of the two studies in order to see if key elements of the game could be matched with key aspects of the addressed mathematical contents. This comparison corresponds to a study of feasibility.

According to the first study some structural, and effective, elements of the game were identified (to help readability we name the challenging player as player A, and the challenged player as player B, thus player B has to guess the robot created by player A to produce the sequence of numbers sent by A to B):

- Playful and competitive context based on the idea of challenge.
- Player A had to create a robot which is able to produce a sequence that it is difficult to guess. Such a robot is the computational correspondence of a formula/procedure producing the sequence.
- Player A had to send a 'product' (the box containing the sequence of numbers produced) to player B.
- Player B had to analyse the received 'product' (the box) in order to guess what kind of robot could have produced it.
- Player B had to respond by sending back a new robot which could replicate the product (namely the sequence of numbers) produced by the robot used by player A.
- The fact that the idea of equivalence was strictly connected with a key rule of the game which was deliberately left unclear. Many different robots can replicate a given number sequence, so it had to be to decided whether in order to consider a response as a good guess, the proposed robot needed to be exactly identical to the original one, or if it is enough that it is able to produce the same sequence as the original one. In the 'Guess my robot' experience this was left open and this choice

caused pupils to start a discussion which led them to a concept of equivalence of number sequences.

– Player B, in order to guess, might need to ask player A to provide more numbers. In a sense, the bigger the set of numbers sent from A to B, the easier it might be for B to guess the robot.

In order to design the new game it was thus first of all necessary to design computational objects which could play the roles of the robots, to produce something relevant to probability and which could be contained in boxes.

Following the historical/epistemological study ITD identified sample spaces, and sequences of items randomly picked from sample spaces, as the key elements for addressing probability. A sample space is a set of objects which can be picked randomly. Thus using ToonTalk a computational object was designed called Random Garden which is simply a green rectangle where a user can put any object available in ToonTalk (it could be a flower, a tree, numbers, text, etc.); once a garden has been set up and filled with objects, the user can give a number to a specific ToonTalk bird which will fly into the garden and come back with a box containing a corresponding number of copies of objects randomly picked from the garden, in other words a sequence of extractions from the sample space.

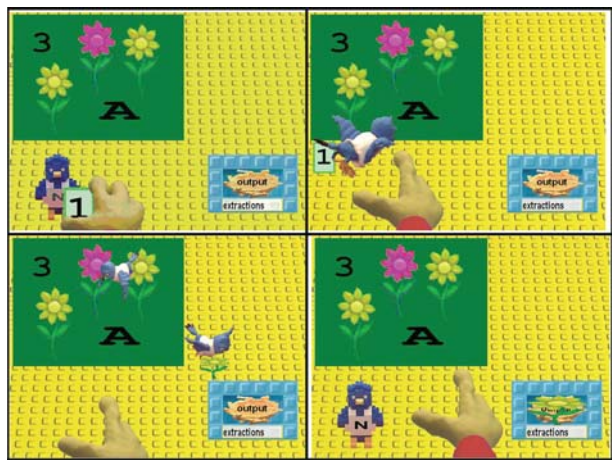

Figure 1. Random Garden.

It was thus possible to think of a ‘Guess my Garden’ game: challenger A sets up a garden and sends B a set of objects (contained in a box) extracted from such garden; player B has to guess what garden produced the received box and sends a garden as a response to the challenge.

ITD matched the above key elements of the ‘Guess my robot’ game with the results of the study of the concept of probability, trying to design and study the feasibility of the new game:

– Playful and competitive context based on the idea of challenge: this would have been granted by the following issues.
– Player A creates a garden that is difficult to guess. Such a garden is the computational correspondence of a sample space producing the sequence of extractions.
– Player A sends a 'product' (the box containing the sequence of objects randomly picked from the garden) to player B.
– Player B analyses the received 'product' (the box) in order to guess what kind of garden could have produced it.
– Player B has to respond by sending back a new garden which can replicate the product produced by the robot used by player A.
– The idea of equivalence of sample spaces can be strictly connected with a key rule of the game left unclear: how to establish if B had guessed correctly or not? Many different gardens (sample spaces) can replicate a given sequence of objects, so a decision has to be made whether in order to consider a response as a good guess, it is necessary that the proposed garden has to be exactly identical to the original one, or if it is enough that it is able to produce a sequence similar to the original one. In the 'Guess my garden' game this could be left open in order to generate a discussion which might lead the students to a concept of equivalence of random gardens (thus sample spaces).
– The fact that player B, in order to guess, might need to ask player A to provide more picked objects. The bigger is the set of numbers sent from A to B, the easier it might be for B to guess the challenge. This corresponds to the law of large numbers.

The two mathematical topics are different, and this is reflected in the game. In particular, to compare two sequences of numbers is easy; they are identical if and only if the formulas/procedures (thus the robots) that produced them are algebraically equivalent. This is not true in the case of sample spaces, a given random garden (thus sample space) may produce a different sequence of objects each time, but all such sequences (if big enough) are equivalent to each other with respect to the proportions of the different objects picked from the sample space. If two thirds of the sample space consists of yellow flowers, then, if a sequence is big enough, two thirds (roughly) of the picked objects will be yellow flowers. In other words the concept of equivalence of sample spaces is strictly related with the classical definition of probability and with a probabilistic concept of equivalence of sets of objects. This certainly marked a difference with the case of the 'Guess my robot' game, but did not impede the design of the 'Guess my garden' game.

RESULTS

ITD set up the game and experimented with it successfully. We believe that success of the content morphing of the games was due mainly to:

– A good analysis of the 'Guess my robot' game, and of the history and epistemology of the concept of probability.
– The fact that both in the case of the number sequences and probability it is possible to address the concepts in terms of a mechanism to produce a sequence.
– The fact that both in the case of the number sequences and probability a key role is played by the concept of equivalence of both, sequences of produced objects, and mechanisms producing the objects.
– The fact that with ToonTalk we could actually design any kind of computational object we needed.

This experience led us to the formulation of the content morph pattern (http://lp.noe-kaleidoscope.org/workspace/patterns/Content_morph/) project which is presented in 1.2.6. More details on specific results can be found in Cerulli et al. (2007) and Pratt et al. (2009).

LESSONS LEARNED

Given an educational mathematical game, it is possible to try to identify its crucial educational elements and re-employ them to design a game addressing a different mathematical concept. In order to do that one has to distil the original game and identify what are the key elements that characterise it. At the same time one has to distil the new mathematical concept which is to be addressed in order to find if, and how, key aspects can be matched with the identified key elements of the original game. If this turns out to be possible then it is possible to 'morph' the original game to a new one addressing the new contents. This might not always be possible, in particular in our case we doubt that we could have been successful if the new considered mathematical concept did not fulfil the requirements highlighted in the results section.

REFERENCES

Cerulli, M., Chioccariello, A., & Lemut, E. (2007). A microworld to implant a germ of probability. In D. Oiaa-Pantazi, & G. Philippou (Eds.), *Proceedings of the Fifth Congress of the European Society for Research in Mathematics Education*, Larnaca, Cyprus: University of Cyprus, Department of Education.

Pratt, D., Winters, N., Cerulli, M., & Leemkuil, H. (2009). A patterns approach to connecting the design and deployment of mathematical games and simulations. In N. Balacheff, S. Ludvigsen, T. de Jong, A. Lazonder, & S. Barnes (Eds.), *Technology-Enhanced learning.* Heidelberg: Springer.

AFFILIATION

Michele Cerulli
The Istituto per le Tecnologie Didattiche (ITD)
Genova
Italy