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Scoping a vision for formative e-assessment: a project report for JISC version 2.0

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1 EXECUTIVE SUMMARY

1.1 Purpose

This report is intended for software developers looking to integrate formative e-assessment with existing e-learning technologies and other post-16 practitioners using formative e-assessment, in order to support them in making more effective use of formative assessment.

1.2 Formative e-assessment

We define formative e-assessment as the use of ICT to support the iterative process of gathering and analysing information about student learning by teachers as well as learners and of evaluating it in relation to prior achievement and attainment of intended, as well as unintended learning outcomes, in a way that allows the teacher or student to adjust the learning trajectory.

Black and Wiliam (2009) conceptualise formative assessment in terms of five key strategies:

1. engineering effective classroom discussion, questions, and learning tasks that elicit evidence of learning;
2. providing feedback that moves learners forward;
3. clarifying and sharing learning intentions and criteria for success;
4. activating students as owners of their own learning; and
5. activating students as instructional resources for one another.

	Where the learner is going	Where the learner is	How to get there
Teacher	Clarify and share learning intentions	Engineering effective discussions, tasks and activities that elicit evidence of learning	Providing feedback that moves learners forward
Peer	Understand and share learning intentions	Activating learners as learning resources for one another	
Learner	Understand learning intentions	Activating learners as owners of their own learning	

Figure 1: Key aspects of formative assessment (Black and Wiliam, 2009)

No assessment technology is in itself formative, but almost any technology can be used in a formative way – if the right conditions are set in place. This observation is in line with a socio-technical view of educational systems, which sees the technological dimensions (e.g. speed, storage capacity, processing, communication, construction and representation and mutability) as inseparable from the pedagogical parameters (e.g. verbal/electronic/synchronous/asynchronous interaction between key players which brings about changes in concepts or skills). It is consistent with a view of learning as 'conversational', and this range of combined resources impacts not only on how students act but also informs what teachers do to enhance learning. In the domain of formative assessment, the pivotal factor we wish to propose is the concept of Moments of Contingency: critical points in the teaching and learning process where the flow of instruction cannot be predetermined (Black and Wiliam, 2009). Moments of contingency contain within them the scope for learners' understanding to be 'otherwise'. The technology itself does not create these moments; they are dependent on teachers' and learners' actions. But for technology to perform formatively, it needs to acknowledge and support these moments.

The report develops an extended vision for formative e-assessment.

1.3 Key points from the literature

- There are widely differing theoretical emphases in the literature and, within e-assessment, a tendency to conflate formative and summative assessment, within a view of 'adaptivity' as a core component of e-assessment processes.

- A core component around which there is much difference is the role of the 'teacher' and to what extent their role in formative assessment includes adaptation of pedagogy. To what extent is 'monitoring' and 'managing' assessment processes formative in terms of transforming the learning environment or pedagogy in response to evidence of learners' progress?

- Some examples of formative e-assessment can be argued to be serial summative assessment. Formative assessment appears to be equated with 'low stakes' assessment, or 'practice' assessment in preparation or contributing towards high stakes summative outcomes.

- The role of 'evidence' is core (how it is used, generated, by whom/what and affecting whom/what). When thinking about assessment as a noun, it is useful to distinguish the event which generates the evidence (e.g. a test as 'an assessment') and the evidence itself (the score).

- Learner self-regulation is a core feature, linked to motivation and emotional factors which affect learners' engagement with feedback.

1.4 Methodology

Practitioners were prompted to recount their experiences of using formative e-assessment as case stories, and discuss these with their peers. The construction and discussion of these narratives were scaffolded by a set of tools and activities to extract transferable and verifiable elements of design knowledge in the form of design patterns. These patterns were then applied to novel problems from real situations by both teachers and software developers to develop use scenarios.

1.5 Case Studies

A major section of the report describes a series of exemplars of e-assessment practice currently to be found across the sector. The case studies described are: *Academic writing, Audiofiles, Como: mobiles + flickr = co-reflective practice, Open Mentor, String Comparison, Medical students, Shadows, Personal Response System (PRS), Click.* These case studies constitute the data from which design patterns for formative e-assessment were developed.

1.6 Patterns

Another major section of the report presents ten design patterns (Classroom Display, Feedback on Feedback, Narrative Spaces, Objects To Talk With, Round and Deep, Showcase Learning, Soft Scaffolding, Try Once, Refine Once, Wear Your Skills on Your Shirt, Use my stuff) derived from the case studies. The patterns serve as mediational tools: on the one hand they provide stimuli for practitioners to critically review and innovate their practice; on the other hand they provide a basis for an understanding of key pedagogical issues attendant to formative e-assessment for software developers. These patterns are mapped against the five key learning strategies derived from the literature and shown in Figure 1.

1.7 What 'e' adds to formative assessment

- Speed

    1. Speed of response is often important in enabling feedback to have an effect
    2. Supports rapid iteration – the ability to give feedback quickly means that the student's next problem solving iteration can begin more quickly.

- Storage capacity - ability to access very large amounts of data (so appropriate feedback/additional work/illustrations can be identified).

- Processing

    1. Automation - in some situations the e-assessment system can analyse responses automatically and provide appropriate feedback
    2. Scalability – can often be the result of some level of automation
    3. Adaptivity – systems can adapt to students.

- Communication

    1. Often the advantage of the 'e' is that it enables rapid communication of ideas across a range of audiences, and the technology allows this range to be controlled, it can be just one person, a group, a class or more
    2. This communication aspect means that aspects of communication can be captured and given a degree of semi-permanence
    3. This semi-permanence supports the sharing of intellectual objects.

- Construction and representation

    1. Representation – the ability to represent ideas in a variety of ways and to move and translate between these representations
    2. Technology can support learners in the representation of their own ideas
    3. Through representation technology enables concepts to be 'shaped' and this helps learners develops their meaning
    4. In representing their ideas in digital artefacts learners open up a window on their thinking.

- Mutability – shared objects are not fixed, they can change/be changed easily.

1.8 Key recommendations

- Developers wishing to address formative e-assessment, both developers of new assessment tools, and those wishing to introduce elements of formative assessment into existing e-learning systems should consult the pattern collections in this domain.

- Existing e-learning tools should be adapted to function in a formative way through the identification of design patterns of formative e-assessment that can be readily applied to these systems.

- Developers need to beware of the danger of applying the 'right pattern to the wrong problem', as patterns derive their power from being context and problem dependent.

- JISC should fund further research to develop a comprehensive language of design patterns for formative e-assessment. and to engage interdisciplinary communities of educators and software developers in iterative participatory pattern-based production of tools for formative e-assessment.

1.9 Supporting material

- Case Studies, Patterns, Scenarios and other materials associated with the Practical Enquiry Days: available in the project Wiki (http://purl.org/planet/Groups.FormativeEAssessment)

- Key presentations: available in the output section of the project blog (http://feasst.wordpress.com/outputs/).

- A database of key bibliographical references: (http://www.bibsonomy.org/tag/WLEFormativeEAssessment)

- A detailed literature review: (http://purl.org/planet/Groups.FormativeEAssessment/Literature+Review).

2 A VISION FOR FORMATIVE E-ASSESSMENT

Reflecting on the path we took in this study, and the insights which have emerged, two key points stand out. The first issue we wish to highlight is that no assessment technology is in itself formative, but almost any technology can be used in a formative way – if the right conditions are set in place. This observation is in line with a socio-technical view of educational systems, which sees the technological dimensions (e.g. speed, storage capacity, processing, communication, construction and representation and mutability) as inseparable from the pedagogical parameters (e.g. verbal/electronic/synchronous/asynchronous interaction between key players which brings about changes in concepts or skills). It is consistent with a view of learning as 'conversational', and this range of combined resources impacts not only on how students act but also informs what teachers do to enhance learning. In the domain of formative assessment, the pivotal factor we wish to propose is the concept of Moments of Contingency: critical points in the teaching and learning process where the flow of instruction cannot be predetermined (Black and Wiliam, 2009). Moments of contingency contain within them the scope for learners' understanding to be 'otherwise'. The technology itself does not create these moments; they are dependent on teachers' and learners' actions. But for technology to perform formatively, it needs to acknowledge and support these moments.

The second assertion we wish to posit is that formative e-assessment is incredibly complex, since it requires the delicate orchestration of social, pedagogical and technological systems. Any framework of design and development attempting to address this domain needs to identify methodological tools which allow it to deal with such complexities. Such tools need to balance the need for a crisp directive for action with a rich representation of context, intentions and possible solutions. In our study, we found the Planet methodology – which combines cases, design patterns and future scenarios – to be a valuable asset in this respect. We strongly advise against an early commitment to a simplified modelling scheme. Instead, a framework should supply a range of modelling tools which act as boundary objects in a continuous design level discussion between all stakeholders in an iterative, user-centric development process.

As part of our pedagogical vision we see processes take place within broader frameworks of learning which have formative effects. Such processes are based on the roles of key players (teachers, individual learners, peers) and a range

of practical and discursive actions in which they participate. As can be seen clearly from the cases and patterns developed through this project, technology does not in itself bring about formative effects. 'Formative e-assessment', we argue, is better understood as multiple processes involving technologies to greater or lesser degrees, where evidence is generated about a learner's state of understanding relative to desirable goals, and where individuals are enabled to take actions which bring about changes in learners' skills, knowledge and understanding, or in teachers' pedagogical practice. What is key is not how we assess but what we do with the data we generate as a result of interventions which can be supported by technologies.

By developing cases of practice which use technologies formatively we have been able to identify patterns which capture key features of formative assessment processes. The patterns suggest that there are key technological attributes or 'resources' which appear to make a difference to the learners' potential for improvement, because of the way the technology contributed to creating moments of contingency. The technology does not in and of itself create these moments of contingency, however. These depend on the set of human responses, motivational factors and socio-interactive contexts which create opportunities for the choices learners make and actions taken in conjunction with feedback and interaction offered by electronic tools. The tools do have particular shaping effects on the types of choices and actions which can emerge. The technologies we describe in the cases and patterns help to constitute the learning environment and contribute to shaping the contingent possibilities which are part of it.

Formative e-assessment is thus a set of processes involving both technological and social resources by which individuals (both learners and teachers) are enabled to engage agentively with evidence of learning, in order to effect changes in understanding. Such engagement we see as crucial to 'moments of contingency'. Moments of contingency contain within them the scope for learners' understanding to be 'otherwise', and there are limits to the extent to which learning can be predetermined. Invariably, part of our vision has to be the recognition that students may not improve despite engaging with technological and social resources; also, technology cannot guarantee moments of contingency. It is the learners and teachers as human actors who ultimately determine the formative effects of engaging with technologies, but technologies can shape the potential for this to happen.

In suggesting a 'vision' for formative e-assessment, we have extracted key features which emerged from the research and which seem consistent with core

ideas from the literature and with the practices and patterns we examined. It is important to state that any vision is necessarily complex, and we have resisted both simplified or overblown claims for what a 'vision' might look like. Instead, the vision which emerges is one which links formative e-assessment to wider frameworks for understanding learning involving technologies. It is only when it is located in wider understandings of effective learning that the potentials of electronic tools to contribute to formative assessment can be understood and optimised.

3 PROJECT OVERVIEW

3.1 Background

This report documents a Joint Information Systems Committee (JISC) funded project entitled 'Scoping a vision for formative e-assessment (FEASST)' (June 2008 – January 2009) led by the WLE Centre for Excellence and the London Knowledge Lab at the Institute of Education, London.

The project took place against the background of an increasing recognition in the UK that the important work on formative assessment and assessment for learning carried out largely within the school sector should find more widespread inclusion in post-16 pedagogy. The increasing prevalence of digital technologies in teaching and learning represents a further challenge. As a project team we were particularly interested in the human-centric, social dimension, rather than a data-centric perspective, on e-assessment. Assessment is integral to teaching and learning. It plays a prominent role in educational policy making, in particular in the context of attempts of successive governments of raising standards. There also exists a substantial amount of significant research into assessment. The main outcomes of this research have included a distinct focus, certainly in maintained settings such as schools, on assessment for learning, i.e. assessment practices and techniques which actively move the learner on to make progress and improve their understanding of how and why they are learning in the way they are. Assessment for learning has evolved from formative assessment and is contrasted with assessment of learning, the broad equivalent of summative assessment. Despite sustained efforts, for example, of Subject Centres and the Higher Education Academy, summative approaches to assessment still prevail, in particular in the form of end-of module assignments and unseen time-constrained written examinations and tests, and where formative assessment often remains conceptualized simply as distributed summative assessment. One challenge, therefore, for post-16 education remains the alignment of assessment practice with the insights and recommendations of research findings which clearly show that assessment for learning is premised on the notion that learners will improve most if they understand the aims and processes of their learning, i.e. posses a certain amount of reflexivity at a metalevel, know where they are positioned in relation to the intended learning outcomes and how they can achieve them or close the gap in their knowledge, skills and/or understanding. It centres on activities by teachers and/or learners that provide information that yield feedback suitable to make necessary modifications to teaching and learning activities, i.e. those that lead to learners having a

better understanding of what they are trying to learn, what is expected of them and how to make improvements. Ostensibly, assessment for learning can be seen to be premised on high quality interactions, including questioning, listening, responding and reflecting, between teacher and learners, learners and learners as well as learners with themselves. In this way, assessment can be seen to be integral to much of what goes on in a classroom.

With the increasing prevalence of ICT in teaching and learning a further challenge pertains to the integration of the insights in the area of assessment in technology-enhanced settings. In the UK policy context, e-assessment tends to be understood as 'end-to-end electronic assessment processes where ICT is used for the presentation of assessment activity, and the recording of responses' (JISC, 2007, p. 6). The focus of work has been on institutional strategy, the development of standards as well as on technical infrastructure and learning support and much less on the pedagogical dimension. The latter is on the increase, though, not least in view of a recent policy focus on personalisation and e-portfolios[1]. We posit that in addition to increased efficiency in the provision of on-demand assessment opportunities and attendant feedback, effective e-assessment also needs to take account of the human-centric, social dimension as well as the data-centric perspective. Formative e-assessment, for the purposes of this study, is understood as the use of ICT to support the iterative process of gathering and analysing information about student learning by teachers as well as learners and of evaluating it in relation to prior achievement and attainment of intended, as well as unintended learning outcomes, in a way that allows the teacher or student to adjust the learning trajectory.

3.2 Aims and scope of the project

The project team carried out a literature review across the areas of (formative) assessment (including assessment for learning), e-assessment and formative e-assessment, but e-portfolios were excluded within the project call. Using the design pattern methodology, the project developed a range of case studies of formative e-assessment with practitioners across a range of settings (from Primary to Higher education) through a series of Practical Enquiry Days. From a selection of these cases the project team abstracted patterns, the richest of which, in turn, were analysed against the findings from the literature review. The

1 See e.g. http://www.jisc.ac.uk/publications/publications/pub_eportfolio_overview/pub_eportfolio_overview_full.aspx and http://nationalstrategies.standards.dcsf.gov.uk/node/85123

team also subjected the patterns to the scrutiny of a group of software developers with a view to deriving examples of pedagogical and technical scenarios of use from them. In a synoptic final step the team mapped the case studies as well as the patterns abstracted from them to the domain map it had derived from the literature review. This report provides an overview of the project, with particular reference to its methodology and outcomes. In addition, it makes some recommendations for future work in the field.

3.3 Links to project-related material

From its inception, the project has been keen to share work in progress in a variety of ways in an attempt to contribute to the building of a community of practice around formative e-assessment, a project aim that has also informed the choice of project methodology around inductive case, pattern and scenario building based on practitioner and software developer input. The project Wiki (http://purl.org/planet/Groups.FormativeEAssessment) offers a repository of material associated with the activities and events undertaken as part of the project, in particular the Practical Enquiry Days and the case studies. The output section of the project blog (http://projects.lkl.ac.uk/feasst/outputs) provides an at-a-glance overview of the key presentations made by a range of speakers throughout the project. The database of key bibliographical references collected as part of the literature review for this project is also freely available on Bibsonomy (http://www.bibsonomy.org/tag/WLEFormativeEAssessment) as is a detailed literature review (http://purl.org/planet/Groups.FormativeEAssessment/Literature+Review). The project team has contacted the relevant JISC personnel to explore how best to represent the case studies, design patterns and scenarios developed as part of the project on the eFramework Knowledge Base.

3.4 Evaluation

The project methodology was subject to an evaluation by a researcher external to the project team, which consists of three elements. First, a review of the aims of the design patterns methodology. These were discussed with researchers on the project responsible for the design and implementation of this methodology. Second, a review carried out by the evaluator of one of the workshop days, as well as the project web site. Field notes were taken to identify how the methodological design constructs a context for the description of formative e-assessment and how this takes place in practice. A focus of this aspect of the evaluation is whether the methodology reaches

its aims in allowing the generation of 'new' descriptions (e.g. descriptions which address limitations with the existing research on formative e-assessment). Third, practitioners who took part in the project were e-mailed questionnaires focusing on how the methodology structured their participation in the project. Again, here the focus is on whether the methodology reaches its aims in foregrounding particular 'voices', notably the voices of practitioners. The advantages and disadvantages of this methodology in documenting good practice will be evaluated in the light of other possible methods for doing this.

The evaluation was not intended to be distant and critical, but supportive of future research. The aim therefore was to make judgements about the methodology's internal consistency (the extent to which it realises its aims), rather than its external consistency (its value compared to other methodologies), and to highlight how this methodological approach might be enhanced in any future projects, in the light of experience. In this respect, the evaluation focused on raising questions about the methodology as it is practised, with a view to enhancing this practice over time.

3.5 Benefits realisation

The project team is adopting an active approach to benefits realisation. In addition to presenting the project outcomes at various national and international conferences (e.g. JISC e-learning programme meeting CAL 09), the team organised a well attended one day dissemination event at the Institute of Education, London on April 28, 2008 (http://www.wlecentre.ac.uk/cms/files/events/feasst_dissemination_day_poster.pdf). Importantly also, following some brokering by the JISC project manager, members of the team are in discussions with the Learning Societies Lab at the University of Southampton to explore how specific project recommendations might be taken up by software developers – a site visit by members of the project team took place in April 2009. With the exception of the dissemination event, these activities fall outside the scope of the project and are self-funded. To ensure maximum benefits realisation, the project team recommends the funding of an online self-evaluation, design-support and staff development tool for formative e-assessment based on the findings of the project.

4 LITERATURE REVIEW

4.1 Issues from the literature

4.1.1 Introduction

As noted above, a key task for the project was to identify processes which take place around formative assessment where technologies play a significant role. These processes are contextualized in a variety ways (e.g. purposes, curriculum goals, phase of education, technological affordances), which need to be understood in order to be able to delineate design patterns for software developers with high relevance for users. This section provides a brief summary on issues from the literature. For a fuller account of the literature search, see the project wiki outcomes page: (http://purl.org/planet/Groups.FormativeEAssessment/Literature+Review)

The full set of bibliographical references collected in the context of this project can be found at: http://www.bibsonomy.org/tag/WLEFormativeEAssessment

The purpose of the literature review was to identify the current theories and practices relating to formative assessment where technologies play a key role. It aimed to define the 'domain' of formative e-assessment, and to identify the features of the processes involved. It examined:

- key theoretical views on formative assessment;
- the role of technologies in a variety of formative assessment settings and
- examples of cases of formative assessment using technologies.

The aim was not to arrive at an overall 'definition' of formative e-assessment, or to define some practices as being preferable over others. The challenge is to identify what exactly is the contribution of technologies to formative assessment processes? It means asking – where does technology actually make a difference in terms of formative assessment? What can it do which is not better done in a different way? This means two main theoretical undertakings which are essentially linked:

1. identifying what counts as formative e-assessment;
2. identifying formative assessment processes within a larger framework of learning and teaching where they 'make sense'.

In relation to (1), identifying 'what counts' as formative e-assessment (the domain) there are considerable differences in the literature, based on views concerning teacher roles, adaptivity, learner self-regulation and unclear distinctions between formative assessment and 'serial summative assessment'.

In relation to (2), two frameworks emerged as potentially relevant for the project to consider as a contextual basis for developing the cases and process models (Laurillard's Conversational Framework (CF) (2002) and Almond et al's (2002) Evidence Centred Design). These will be discussed in Section 4.3 and 4.4.

4.1.2 Towards defining the domain

There is wide heterogeneity in the literature on formative e-assessment, and frequent slippage between terms like 'assessment' and 'learning', and 'formative' and 'summative' (especially in papers exploring computer-based assessment tools). The domain in relation to technologies is therefore complex and contentious. It is important to identify the core meanings of 'formative assessment' as a starting point for what should be included in models which capture the processes of formative e-assessment. This impacted on the project in so far as a considerable amount of time during the during Practical Enquiry Days, and most certainly during frequent team meetings, was given over to the exploration of a domain map which was useful for mapping cases from a range of formative assessment contexts and attendant patterns for all stakeholders (i.e. practitioners as well as software developers). In the event, the team decided to opt for Black and Wiliam's (2009) framework, discussed below augmented with the Conversational Framework (see Section 4.3 below).

4.1.3 Key points from the literature

1. There are widely differing theoretical emphases in the literature and, within e-assessment, a tendency to conflate formative and summative assessment, within a view of 'adaptivity' as a core component of e-assessment processes. ('Adaptivity' here indicating the flexible responsiveness on the part of learners and teachers which may or may not itself involve the use of technology). The domain includes a wide variety of perspectives and practices under the term 'formative assessment' which prioritise different educational goals.
2. Components have been identified to reflect a variety of actors, learning intentions, roles and activities, and the mechanisms involved in enabling progression of learning towards measurable attributes.
3. Among these, a core component around which there is much difference

is the role of the 'teacher' and to what extent their role in formative assessment includes adaptation of pedagogy. To what extent is 'monitoring' and 'managing' assessment processes formative in terms of transforming the learning environment or pedagogy in response to evidence of learners' progress?

4. Automated response/feedback is classed by some studies as the same as formative assessment.
5. Some examples of formative e-assessment can be argued to be serial summative assessment. Formative assessment appears to be equated with 'low stakes' assessment, or 'practice' assessment in preparation or contributing towards high stakes summative outcomes. The role of 'evidence' is core (how it is used, generated, by whom/what and affecting whom/what). When thinking about assessment as a noun, it is useful to distinguish the event which generates the evidence (e.g. a test as 'an assessment') and the evidence itself (the score).
6. Mechanisms focus on the generation and use of evidence by actors in the assessment process, which has a variety of relations with 'feedback'. Channels are varied – teacher-learner(s), learner(s)-teacher, learner-learner(s).
7. There is a significant difference in views on the impact of grading and scoring on formative assessment processes. The consensus in the literature appears to be that providing grades and scores tends to increase the tendency for learners to adopt performance, rather than mastery goals. Grades and scores can increase motivation in the short term, but in the longer term, the effect appears to be detrimental to formative processes and to learning (Black and Wiliam, 1998).
8. Increased frequency, speed and amount of assessment is a driver to improve student access to feedback – is this performing a formative function?
9. Learner self-regulation is a core feature, linked to motivation and emotional factors which affect learners' engagement with feedback.

4.1.4 Towards a definition of 'formative'

The project needed to develop criteria for the selection of cases of formative e-assessment and for identifying core components of the processes which take place. A key issue was: what views of formative assessment should provide a theoretical foundation for the study and contribute to a domain map to which instances of practice can be linked? There was clearly no consensus in the literature, which is unsurprising and not necessarily desirable. The domain map

would therefore reflect a theoretically coherent account of 'what is out there' as part of a conceptual overview which attempts to make sense of the range and diversity of what currently constitutes formative assessment. It became obvious that the domain would have broad and permeable parameters. This is in line with arguments for a re-definition of terms regarding formative e-assessment, which acknowledges that technologies form part of a shift towards 'modernising' (Elliott, 2007) assessment in contemporary collaborative and personalised learning contexts, and which also takes on the points about 'blurring' boundaries made by Bull and McKenna (2004). In terms of computer-assisted assessment (CAA), Bull and McKenna make a distinction between the idea that it can be formative in itself, and the idea that it has a role to play in formative assessment. This relates to some extent to Dylan Wiliam's observation at the July 2009 Practical Enquiry Day (see http://purl.org/planet/Groups.FormativeEAssessment/3July) that, rather than thinking in terms of 'formative assessment', it might be more appropriate to think in terms of how assessment can be used 'formatively'. The notion that formative and summative assessment become 'blurred' is important:

> perhaps CAA offers a sort of bridge between formative and summative assessments…the line between formative and summative assessment is a blurred one which is more to do with when the assessments are delivered and what is done with the marking and feedback rather than a precise difference in kind (Bull and McKenna, 2004, p. 12)

This is helpful as, when the distinction between formative and summative is located in the assessment itself, it results in a meaningless, or contradictory, formulation. E-assessment practices need careful examination for how they relate to core concepts of formative assessment. Mackenzie's (1999) term 'scored formative' is indicative of this, which describes the practice of automatically assigning and recording numerical scores for computerized coursework. In this context, the feedback functions formatively only according to the wider pedagogical framework of which it is part. Assessment practices based on testing/scoring/recording grades do not always share the pedagogical conditions around teacher-learner roles, which constitute formative assessment in much of the educational literature derived from Black and Wiliam. The inter-relationship between 'the teacher's agenda, the internal world of each student, and the inter-subjective' (Black and Wiliam, 2009) is core to identifying formative assessment practices. This inter-relationship may take a wide variety of forms (e.g. the teacher need not necessarily be present) and result in varying outcomes (e.g. the learner may not make the desired progress), but learners' active engagement with feedback is a consistent element of it. The 'teacher's agenda' can be difficult to ascertain in contexts where technology carries out traditional

teachers' roles. Teacher interventions, pedagogical adaptation and the fostering of self-regulation are crucial aspects of formative assessment in much of the literature based in interactional instructional contexts. Questions are raised (and are not as yet answered) about how technology satisfies the role of the 'social turn' in formative e-assessment, and contributes to the 'internal world' of each learner, beyond the facilitation of tasks.

Fundamental to this complex domain, are tensions associated with e-assessment where practices are driven by state-of-the-art technological know-how rather than pedagogy. We concluded that the project needed to focus on formative e-assessment within meaningful pedagogical contexts to be able to concentrate on examples where technology 'makes a difference' which is worthwhile. The conclusion is that e-assessment (formative and summative) should not be viewed as separate in terms of technical tools and standards but integrated into the tools used for teaching and learning. The cases therefore would be focused on learning and teaching contexts where technologies support:

1. the appropriacy and authenticity of tasks/processes
2. motive, opportunity and means (Shute, 2008) as an integral part of the learning process
3. 'multitrait-multimethod' (Anderson et al, 1975) approaches as an integral part of teaching and learning

An exploration of the role of the 'e' in formative assessment within this view of learning and teaching becomes necessary.

4.2 The role of the 'e'

What does 'e' add to the formative assessment that we have been looking at?

1. Speed

    - Speed of response is often important in enabling feedback to have an effect
    - Supports rapid iteration – in many cases the ability to give feedback quickly means that the student's next problem solving iteration can begin more quickly. (Examples include automated feedback on skills performance like grammar exercises – 'String comparison' (http://purl.org/planet/Cases/Stringcomparisoninlanguagelearning)

2. Storage capacity

   - Ability to access very large amounts of data (so appropriate feedback/ additional work/illustrations can be identified). (Examples include customizing digital library resources to individual learner needs within a domain content knowledge base – 'CLICK' (http://purl.org/planet/Cases/CustomizedlearningserviceforconceptknowledgeCLICK)

3. Processing

   - Automation – in some situations the e-assessment system can analyse responses automatically and provide appropriate feedback. (Examples include feedback on grammar in language learning support systems – 'eGramm' (http://purl.org/planet/Cases/egramm), and FeedbackonFeedback (http://purl.org/planet/Patterns/FeedbackonFeedback) where tutors feedback was automatically described)
   - Scalability – can often be the result of some level of automation
   - Adaptivity – systems can adapt to students

4. Communication

   - Often the advantage of the 'e' is that it enables rapid communication of ideas across a range of audiences, and the technology allows this range to be controlled it can be just one person, a group, a class or more
   - This communication aspect means that aspects of communication can be captured and given a degree of semi-permanence
   - This semi permanence supports the sharing of intellectual objects. (Examples include learners using mobile phones to send assessment information to a server to be processed, which they can then revisit online to focus areas for improvement - 'Medical Students' (http://purl.org/planet/Cases/ALPSSchoolofMedicine), and 'Audiofiles' which mediate 'authenticity' in feedback (http://purl.org/planet/Cases/Audiofiles)

5. Construction and representation

   - Representation – the ability to represent ideas in a variety of ways and to move and translate between these representations
   - Technology can support learners in the construction of representations of their own ideas.
   - By representation technology enables concepts to be 'shaped' and therefore affects their meaning, i.e. representation makes use of symbols

which help meanings develop
- In representing their ideas in digital artefacts (creating these intellectual objects) learners open up a window on their thinking. (Examples include using mobile devices to capture images representing key learner practices – 'CoMo' (http://purl.org/planet/Cases/CoMo) and using Interactive Whiteboards to support and capture concept formation through visual representation of understanding – 'Shadows' (http://purl.org/planet/Cases/Shadows)

6. Mutability - shared objects are not fixed, they can change be changed easily and quickly. (Examples include the use of a wiki to support building collaborative frameworks of ideas over time within critical audience conditions – 'Academic writing' (http://purl.org/planet/Cases/Academicwriting)

4.3 The Conversational Framework

Diana Laurillard's (2002, 2007) Conversational Framework has long been influential in the design of e-learning. It therefore seemed a reasonable basis to start a consideration of how technology might support the use of formative assessment. The diagram below represents a learning activity that covers the full Conversational Framework through a combination of teaching methods, such as lecture/book/web resource + tutorial/discussion environment + fieldwork/lab/simulation + collaboration environment.

The use of formative assessment in the way that we are using the term potentially overlaps with most of the elements of this framework, that is it corresponds to most of the elements of the learning process, other than perhaps those elements which relate to the teacher's initial presentation of the concepts.

At the simplest level:

- Teacher assessment can be seen in this framework in the Adapt a Task practice environment for learners' needs activity – where the task might be an assessment task – and then the results of the assessment are fed back to the learner in the Feedback on action activity.
- Assessment is formative if this feedback either results in the learner adapting his/her conception (Reflects on feedback in relation to task and action), changing his/her approach to the task (Adapts approach to task to current conception) and ultimately adapting his/her action (Revises action) while the teacher 'Reflects on learners' practice' and thereby modifies the learn-

ing and assessment task (Adapts a Task practice environment for learners' needs).

- Peer assessment can be seen in this framework where learners share their activities (Shares practice attempt) and as consequence reflect on this (Reflects on alternate practice), change their concepts and hence 'Adapt approach to task to current conception'.

This mapping was seen to be sufficiently strong to merit adoption of this framework for analysis of activities within formative assessment and further discussion of this will be presented in the analysis section of this report.

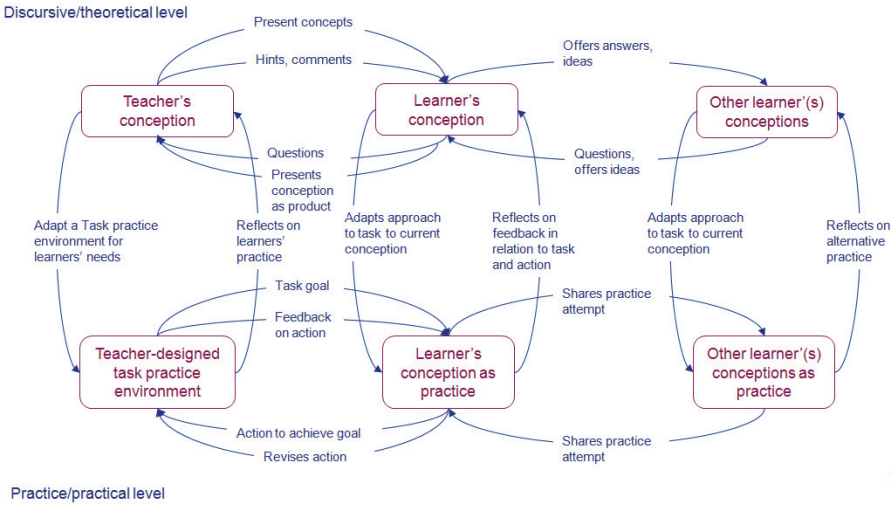

Figure 2: the Conversational Framework

4.4 Evidence Centred (Assessment) Design

Evidence Centred Design (ECD) is one of the most highly developed approaches to the design of assessment – arising from work of Almond et al. (2002) and Mislevy et al (2003) originally working at the Educational Testing Service (ETS) – and was initially a prime candidate for consideration as a framework for our study.

The ECD approach insists on the importance of starting the assessment design process with a thoughtful consideration of just what one wishes to assess. This stage of Domain Analysis then leads to the stage of Domain Modelling, and we were interested in the way in which Mislevy et al (2003) has used Design Patterns for Domain Modelling. They argue that:

> design pattern helps the assessment designer structure a coherent assessment story line by making explicit each of the three building blocks for an assessment argument:
>
> 1. The knowledge, skills, and abilities (KSAs) that one wants to know about.
> 2. The kinds of observations that would provide evidence about those KSAs.
> 3. Characteristic features of tasks describing the types of situations that could help evoke that evidence.
>
> (Mislevy et al 2003, p. 23)

The next stage of the ECD approach is the Conceptual Assessment Framework – which provides the technical detail required for implementation: the assembly model, students models, evidence model, task model, and presentation model.

Then finally Assessment Assembly and Assessment Delivery are handled by the four process architecture for assessment delivery. These four processes carry out the functions of selecting and administering tasks (Activity selection), interacting as required with the examinee to present materials and capture work products (Presentation), then evaluate responses from each task (Response processing) and accumulate evidence across them (Summary scoring).

The approach potentially covers a wide range of both formative and summative assessment forms, as well as tutoring systems, and provides a strong framework for describing their implementation. For any specific purpose we would not be interested in implementing the whole of the approach, but it could provide a framework in which to fit the various elements that we did assemble.

The attractions for this project in this approach were:

- the approach was at a reasonably high level of abstraction, and so left room for considerable implementation flexibility;
- the adaptability to a wide range of forms of assessment would mean that we would not have to pre-judge what constitutes formative assessment;

- the delivery process was implementation independent (i.e. any process could be implemented through face to face interactions, or be partially or wholly mediated by technology);
- the use of design patterns, which was methodology that one member of the team was very familiar with.

However, after further attempts to work with this approach we decided not to go further with it in this study (whilst not rejecting it for future use) for a variety of reasons:

- we were often only interested in exploring systems looking at parts of the overall process and so the full architecture was beyond our needs;
- whilst it could be made to work for a wide variety of forms of both summative and formative assessment as well as a basis for tutoring system it was quite removed from some of the more open ended forms of work that we were seeing in practice;
- whilst it was indeed implementation independent (in the sense that it did not commit any process to be done by human or machine) it was nevertheless too close to implementation detail for the stage of work that we were at;
- most crucially, it did not provide a theory of learning, or a theory of formative assessment.

5 PROJECT METHODOLOGY

5.1 Summary

Formative assessment is continuously embedded in the teaching and learning process; its interaction with the multiple dimensions of this process create a highly complex domain. We need a methodology that is capable of taking in the complexity and fluidity of this domain. We identified the potential of the pattern-based methodology of the JISC funded Planet project. This methodology was combined with standard social science procedures. We considered the relationship between our outputs and explicit software production processes, and concluded that our patterns provide rich and distinctive specifications for developers. They need to be accompanied by meta-level descriptions at the semantic and navigational levels. Detailed domain models need to identified and refined as part of an iterative software development process. Pedagogic design patterns such as ours should include, where relevant, sequence diagrams of the pedagogic process they describe.

5.2 Methodology

Our initial review of the literature exposed the domain of formative e-assessment as an extremely complex one, which is by and large uncharted territory. This complexity arises from the inherent nature of formative assessment, as continuously embedded in the teaching and learning process, and thus interacting with the multitude of factors defining this process. This complexity is compounded by the "e" dimensions; technology introduces new opportunities along with new challenges and reshuffles context of teacher-student interaction. Any methodology which attempts to model this domain and provide a framework for effective design needs to encompass intricate ensembles of social, pedagogical and technical factors, and mediate between theoretical abstractions and pragmatic detail.

These recognitions led us to seek a mode of research which would allow us to synergise theoretical academic and practical expertise. On a theoretical level, standard tools of literature review and consultation provided a straightforward approach. At the professional level, we aimed to go beyond documenting practice; the project team also sought to engage participant informants in thinking through their professional practice in the field of formative e-assessment. We identified the design-pattern based methodology, as developed by the

JISC-funded Planet project (Finlay et al, 2009), as a suitable framework for user engagement, analysis, and modelling. We view these methodological claims as one of the key lessons of the project. We see this approach as supporting enquiry processes in relation to practice in the field of formative e-assessment, be they professional practice- or tool-design related.

The pattern language approach (Alexander, Silverstein & Ishikawa, 1977) was developed as a form of design language within architecture. A design pattern "describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice" (Alexander et al, 1977, p.x). This original definition positions a pattern as a high-level specification of a method of solving a problem by a design that specifies the context of discussion, the particulars of the problem, and how these can be addressed by the designated design instruments.

Mor and Winters (2008) view a design pattern as a semi-structured description of an expert's method for solving a recurrent problem, which includes a description of the problem itself and the context in which the method is applicable, but does not include directives which bind the solution to unique circumstances. Design patterns have the explicit aim of externalizing knowledge to allow accumulation and generalization of solutions and to allow all members of a community or design group to participate in discussion relating to the design. Patterns are organized into coherent systems called pattern languages where patterns are related to each other. The use of design patterns may have never achieved a large following among professional architects, but it has had a tremendous effect in the domain of object-oriented programming. Design patterns as "elements of reusable software design" where proposed by Gamma et al. (1995), the "Gang of four", in what became one of the most widely read books in software engineering. From there, the approach spread to diverse sub-fields, such as hypermedia (German & Cowan, 2000), interaction design (Erickson, 2000; Borchers, 2001), web design (van Duyne et al, 2007) computer-mediated interaction (Schummer & Lukosch, 2007) and computer games (Bjork & Holopainen, 2004).

Since the seminal work of the pedagogical patterns project (Bergin, 2000; Sharp, Manns and Eckstein, 2003), several projects have attempted to introduce a patterns-based approach to educational design, and specifically to the design of educational technology (Derntl & Motschnig-Pitrik, 2005; Goodyear, 2005; McAndrew, Goodyear and Dalziel, 2006; Lukosch and Schümmer, 2006; Retalis, Georgiakakis and Dimitriadis, 2006). Fincher et al (2001) note that patterns are a

particularly suitable format for sharing practice-related knowledge because they offer a representation which "does not prescribe or patronise" and equally does not "overwhelm with information". Despite the vibrant research activity, pattern-based approaches appear to have little impact at the field level. Schümmer, Lukosch and Slagter (2005) argue that this is largely due to the lack of user inclusion in the process of developing pattern languages, inspired by the success of pattern languages in software design. The tradition of pattern languages in computer science has by and large ignored the participatory and conversational aspects highlighted by Alexander, and repurposed them as a format for expert software designers to share their design knowledge with novices. This has proven effective in initiating young engineers in the art of programming, and led to the proliferation of high technical standards. Yet at the same time it has intensified the status of software production as a specialist activity, inaccessible to laypersons, thereby excluding users from the design process. Similar criticism, in the realm of HCI, is raised by Dearden and Finlay (2006).

The IDR methodology, developed by the EU-funded Learning Patterns project (Winters & Mor, 2008) addressed the issues of relevance, acceptance and validity of design patterns in technology enhanced learning by offering a highly-participatory and practice-driven model, engaging interdisciplinary groups of professionals as active partners in collaborative authoring of case studies and extraction of design patterns from these. The JISC-funded Planet project extended the IDR methodology, to a three-workshop model, leading participants from cases to patterns and on to their application to future scenarios. The Planet methodology was used as a framework for this project, and was adapted to our specific settings and constraints. A summary of the Planet methodology is provided as Appendix 1. Further detail is available in the form of a video of an interview between one of the team members and the project evaluator available on the project blog at:

http://projects.lkl.ac.uk/feasst/2008/12/04/caroline-pelletier-interviews-yishay-mor-on-the-project-methodology/

The design patterns we have uncovered offer models of pedagogical processes in the domain of formative e-assessment. Approximately mid-way into the project life cycle we consulted Prof. Balbir Barn of Middlesex university[1] regarding the appropriate relationship between these patterns and industry standard domain-modelling frameworks. Prof. Barn, who was highly supportive of the ap-

1 A summary of the meeting is available at: http://patternlanguagenetwork.org/2008/12/15/good-advice-from-balbir-barn/

proach we took, noted a distinction between our patterns and those prevalent in the object-oriented world. Whereas those patterns typically describe structural features of software, ours highlight aspects of pedagogical processes. Thus, our patterns provide software developers rich and precise functional specifications, which would be addressed by application-specific ensembles of software design patterns. While many object-oriented design books use UML or other modelling patterns to illustrate design patterns, Prof. Barn suggested that these would be too detailed to be productive at our level of description. Domain modelling in UML or BPMN is part of the software development cycle, and should be done by or in consultation with the application developers. In agile development methodologies, domain models are defined very loosely in the inception phase and then refined in tandem with the code at each iteration of user feedback and development. Prof. Barn recommended that we use process diagrams, where relevant, to identify the roles and sequence of actions in a particular educational activity. He also emphasised the need for meta-level descriptions across patterns, what is sometimes known in the pattern lore as the organising structure of the pattern language. Prof. Barn suggested we incorporate two dimensions of meta-level descriptions: a semantic mapping of the key concepts we use, and an overview mapping of links and relationships between patterns, and between patterns and concepts. The semantic dimension is expressed in the parameters listed in section 7 of this report, and the overview mapping is the purpose of the augmented domain map in section 6.5. The connection between the two is also reflected in the tags used for cases and patterns in their on-line version.

5.3 Links and references

This Section offers a list of links and references specifically for the design pattern methodology to afford readers interesting in finding out more about the methodology or in adopting it for their own purposes an opportunity for a focused engagement with relevant issues and background material.

Links

Brad Appleton Patterns and software: essential concepts and terminology http://www.cmcrossroads.com/bradapp/docs/patterns-intro.html

http://hillside.net/

Pedagogical patterns http://www.pedagogicalpatterns.org/

Jutta Eckstein, http://www.jeckstein.com/pedagogicalPatterns/pedagogicalPatterns.html

Robert Mislevy's work on patterns http://padi.sri.com. This is a link to a project on assessment design and one of their main articles on assessment.

The E-LEN project http://www2.tisip.no/E-LEN/
e-LEN Design expertise for e-learning centres: design patterns and how to produce them http://www2.tisip.no/E-LEN/documents/ELEN-Deliverables/booklet-e-len_design_experience.pdf

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6 CASES PATTERNS AND SCENARIOS

6.1 Shortlisted cases and selection criteria

The initial period of the project, in addition to work on the literature review, focused on the generation of information about formative e-assessment in practice with a view to capturing and iterating it into case studies. Concurrently the project team considered a structure for presenting the information gathered. Through participation in Practical Enquiry Days as well as (telephone) interviews, a number of cases were worked up by participants and the project team and captured on the project Wiki. For details of a full list of cases see http://purl.org/planet/Cases/Academicwriting. It soon became apparent that in order to keep the volume of material manageable, as well as to ensure sufficient detail and richness of individual cases, a shortlisting of cases was necessary. A number of criteria were agreed in order to identify those cases from which patterns relevant to formative e-assessment were to be mainly derived. Care needed to be taken to ensure a rich and balanced data set. In the event, the following criteria were used: assessment focus, technology used, role played by the technology, socio-pedagogical setting and institutional setting. Using this as a basis, the following case studies of formative e-assessment were selected:

Cases	Assessment focus	Technology used	Role played by technology	Socio-pedagogical setting	Institutional setting
Academic writing	students' critical understanding of the features of academic writing	wiki	aid communication between learner, teacher and peers, through the presentation & organization of student thinking	peer-to-peer, teacher-student, teacher-group	university masters level initial teacher education programme
Audiofiles	students' knowledge and understanding of key concepts in sociology	Audacity© software; digital audio recording on dictaphones	deliver tutor feedback	teacher-student	university undergraduate

Cases	Assessment focus	Technology used	Role played by technology	Socio-pedagogical setting	Institutional setting
Como: mobiles + flickr = co-reflective practice	recording & reflecting on clinical experiences	mobile devices with camera function; social networking tools	encourage individual reflection & feedback between peers & feedback from tutors to students & student groups	self, peer-to-peer, teacher-student, teacher-group	Higher Education veterinary training, Work-Based Learning
Open Mentor	achieve adequate levels of socio-emotive feedback from teachers	web-based tool	provide graphical feedback to tutors on the adequacy or frequency of comments provided to students	teacher self assessment	distance Higher Education
String comparison	accuracy in written language in complex sentences in language learning	string comparator (bespoke software design)	deliver immediate feedback on written accuracy in multiple language items	self (student self-directed independent interaction with software)	university undergraduate and post-16 foreign language courses

Table 1: Summary of 5 cases

6.1.1 Academic writing

Academic reading and writing is a requirement of postgraduate initial teacher education courses, but on one such course for secondary ICT trainees, many participants found this difficult. Tutors developed a programme to support trainees who were experiencing difficulties with academic writing.
The aim was for trainees to work collaboratively using a wiki to develop strategies for reading academic papers to develop their skills in writing assignments. In pairs, students were asked to brainstorm the question "How do you go about reading an academic paper?" and write a list on paper, while the tutor circu-

lated to monitor their understanding. Then a set of ideas was built up on the wiki by one of the students using a Tablet-pc linked to a data projector so that the developing list could be viewed by the whole group. As each pair contributed an item other group members commented on its appropriateness, value and position in the developing list. Elements of the list were moved around in the wiki page to create an order as agreed by the group. The shared discussion was a process of continuous adjustment where trainees suggested approaches and various ideas were pursued. The developing list was continually changed to reflect the consensus of the group. It was then available as a 'master list' to support academic writing. A following activity asked pairs of trainees to read, highlight and comment electronically on an academic paper, before beginning their own individual writing. The electronic facilities provided were:

- a visual display of the consensus from the discussion as it developed;
- a means for a pair of students to jointly read and annotate a document;
- an aid for students in displaying and explaining their findings to the group; and
- a record that individuals can refer to.

Electronic tools were thus used as aids for communication and presentation in a formative context. The formative nature of the activities derives from the responses of the lecturer and other students that enable a series of feedback loops. These result in continual relatively small adjustments in the ongoing process and feed into future planning. The hope is that individual students are also making adjustments in their thinking. The full case can be found at: http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Cases/Academicwriting

6.1.2 Audiofiles

Audiofiles have been piloted with 25 undergraduate university students in years 1, 2 and 3 in a school of sociology and social policy. They form part of ongoing research and development to improve strategies for tutors to give feedback to students on traditional written essays to help deal with a contemporary challenge – increasing class sizes and less time for staff to spend on feedback on written coursework, leading to inconsistency in feedback even where it is done well. The intervention sought to explore the value of replacing text-based feedback with audio feedback, and to find out 'Does the feedback change?' Tutors used both handheld dictaphones and audio software to record their feedback directly onto a PC. There were no rules about the length of the file. Feedback was recorded in a single audiofile at the conclusion to reading the whole piece of writing and lasted between 90 seconds – 21 minutes. Audiofiles were then

returned to the students via the VLE (Blackboard). The research found that tutors tended to comment more freely than in their equivalent written feedback which tended to conform more closely to the content guidelines of a feedback template sheet. It appears that the nature of the feedback may be affected by the use of audiofiles. Comments were 'richer' and more emphatic which may affect student motivation. In comparing the audio transcripts with written feedback from the same tutors, the feedback tended to be richer, longer, personalised, more immediate and 'authentic'. The process appeared to make tutors reflect more on their own feedback and this led to the desire to amend it. It takes tutors longer to produce however, and further development may help the staff with managing this.

The student work was also being formally assessed, so the students were getting formative outcomes from a summative piece of work, and the approach may be more effective in a purely formative context. Next steps will be to:

- explore audiofiles with other disciplines
- explore the possibilities of inserting feedback at intervals into the body of the documents like 'comment' inserts on word files
- enable tutors to easily edit the word files as they make them.

The full case can be found at: http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Cases/Audiofiles

6.1.3 Como: mobiles + flickr = co-reflective practice

At the Royal Veterinary College, a group of students were engaged in practical work in a vet training hospital. As part of their training, the students were required to capture instances of practice on a mobile phone and the photos collected were automatically uploaded to flickr. The students worked in groups of 4 or 5 and each was provided with a mobile phone and given a short familiarisation session. In one scenario, during morning rounds students would be directed to monitor the progress of an animal being treated. Their task would be to document case progress over time. They took pictures throughout the day, uploaded them to a blog, tagged them with caseID and key features e.g. type of animal, the injury, condition. The students then used quiet moments to add details to the 'case' using blog postings. During the evening rounds, the students presented their cases in group discussion sessions with their tutor, using the images, blog posts and a projector. The group reviewed the diagnosis and the actions which were taken, and reviewed these in the light of revisiting the images and postings which acted as catalysts for evaluation of practice. Co-reflection was

enhanced because of the availability of images which bring the medical case into the seminar room. It affected the students' tutorial conversation, providing ongoing formative contributions to the case in the form of postings. The discussion moved from abstract "textbook theory" to what tutors called "case presentation": how the particular condition presents itself in a particular case, how to analyse symptoms in real-world conditions and how to assess treatment. These are key skills which are often neglected due to the inability to have a concrete presence of the case in the seminar room as a focus for reflective and analytical discussion. The process of using images to capture cases also provided feedback to tutors on the students' learning. Tutors reported that observing students' pictures gave them a window on their thinking: what they noticed, where their attention was and where they assigned importance. This was the basis for modifying tutor input and the focus of the tutorial discussion.

The full case can be found at: http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Cases/CoMo

6.1.4 Open Mentor

Open Mentor is a web system, built to assist tutors at the Open University to provide constructive feedback to students in order to help them improve their work and to give socio-emotive feedback. A premise of the system is that tutor comments should reflect the grade awarded and that the mark given does not speak for itself. It was important for students to understand what they did not know and to enter a dialogue with their tutors. Students need a balance of socio-emotive and cognitive support in their feedback from tutors, and the feedback needs to be relevant to the assigned grade.
Open Mentor was designed to provide tutors with a tool that would assist them with assessing the support and guidance they were giving to students (i.e. their written comments) on their assignments with respect to the mark awarded. To do this, Open Mentor had to analyse the tutor comments. The feedback to tutors was then given in a graphical form illustrating how many comments they had provided to the student which were grouped into the four major Bales' (1970) categories of interaction: positive reactions, negative reactions, questions, and answers. These interactional categories illustrate the balance of socio-emotional comments that support the student. This analysis was then compared to an ideal set of comments which would be given to a student for the particular mark awarded. Tutors often discovered that they needed to use more praise in their comments. Many had believed that the mark spoke for itself. Thus feedback to the tutor is a key feedback loop impacting on tutor feedback to the students. The categories used are domain-independent – this model was used to classify

feedback in a range of academic disciplines. An automatic classification system, therefore, can be used in all fields, without needing a new set of example comments and training for each different discipline. Also, as developers wrote tools that supported feedback, they began to question the notion of feedback itself. Instead, the concept seemed to divide naturally into two different aspects: learning support and learning guidance. Support encourages and motivates the learner, guidance shows them ways of dealing with particular problems.

The full case can be found at: http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Cases/OpenMentor

6.1.5 String Comparison

Undergraduates can take Spanish as an option module while studying other subjects at a UK university and the module grade counts towards the final degree. The students need to practise written language independently and receive feedback on errors in order to improve their language skills. There are large numbers of students taking the module making it time-consuming for tutors to provide detailed individual feedback. Standard parser-based solutions were not feasible since these tend not to be able to cope in the face of poor answers, so a bespoke string (sequence) comparator was designed. Rather than using parsing the system uses fine-granularity sequence comparison to compare correct language strings to a user's answer. With such a technique generic - but detailed - feedback is always given, no matter how confused the user's answer is. Students answer randomly-generated, translation-based questions, grouped into exercises on specific areas of grammar. The comparator marks up errors in their input using colour coding (and font style) to highlight the different types of error: incorrect words, misspelt or misconjugated words, omitted words, redundant words and incorrect word-order. The student is given a second attempt in which to correct the submission based on the feedback received. The sequence comparator is language-independent and feedback is therefore generic in nature (i.e. no specific grammatical clues are given), but this was considered preferable to using a system which would not be able to handle muddled input. Despite the lack of grammatical information in the feedback the system works very well. There is virtually always an improvement between students' first and second answer attempts; but there is also measurable improvement over the course of an exercise. The system sets a minimum and maximum number of questions to be attempted for each exercise. Students can stop after completing the minimum, but can carry on to the maximum if they wish. On average students attempted 50% more questions than they were required to do. As students progress through an exercise their answers become

more accurate while their thinking time decreases which is an indication of improvement in language learning capacity.

The full case can be found at: http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Cases/Stringcomparisoninlanguagelearning

6.2 Additional cases

The Practical Enquiry Days generated a large number of 'seed' cases describing practices in a variety of educational settings where elements of formative assessment were present. Within the scale of the project it has not been possible to develop all of them into full cases from which patterns can be derived. Other cases exist in the literature. There exists a variety of reasons for not developing some very interesting cases of practice. Some reasons were rooted in the challenges which are intrinsic to the collaborative participatory approach to case-building in the project. This needs to be considered in future development of the methodology, as practitioner engagement over time is an important feature in developing authentic cases from which patterns can be derived. Other reasons were rooted in the content focus of the practices which were captured. The reasons for excluding cases can be summarised:

- it was not practical for some practitioners to attend all the PEDs where the cases were developed over time, so practitioners could not take part in ongoing group review and refinement of the cases they owned;
- formative assessment was not a major aspect of some of the practices described;
- there were a number of cases based on similar pedagogical practices, and we have tried to avoid duplication to present a broader range of contexts/technologies/practices;
- some cases were not sufficiently developed for inclusion because it was difficult to engage some practitioners in developing their cases on the wiki outside of the PEDs, due to pressures of time and workload;
- some cases did not fall within the main focus of post-16 sectors;
- some cases were already well-documented elsewhere.

We collected ample material to develop five cases, selecting these according to the criteria outlined above in Section 6.1. In this section we describe examples of additional cases, which were productive to the development of the project by generating rich discussion about formative assessment on the PEDS or in the Wiki, or by providing examples of cases from

other projects which contained helpful examples of formative assessment practices involving technologies. These cases offer detailed accounts of relevant practices and warrant further development in future explorations of design patterns which support formative assessment.

6.2.1 Medical students

Medical students were issued with PDAs to record assessments whilst immersed in a clinical setting (e.g. ward). They were observed and assessed, receiving scores and comments. The PDA delivered this information to a server and a web site allows the students to review their feedback and scores at any time. Students can then discuss these with the assessors or set up a further assessment opportunity to address weaknesses. Reflection is required by the student to identify and address their weaknesses. The PDA may not be the most user-friendly way to do this, and it was suggested that audio recording may be preferable, but the process produces lots of evidence for the students to look at and respond to proactively. Assessors also reported that the process reflected on their teaching practice.

This case was not developed because the main developmental emphasis in the early stages of the innovation was on use of PDAs for the recording and transmission of information about assessments which had taken place. Therefore the role of technology is not critical to the formative assessment processes which may or may not occur. With further development this case has potential to explore the impact of the PDA or other recording and communication technologies on student self-regulation by affecting motivation to be proactive in response to feedback which is made available this way, and take ownership of their learning.

The full case can be found at: http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Cases/ALPSSchoolofMedicine

6.2.2 Shadows

Primary school teachers used an IWB to enable pupils to represent their understandings of how shadows are formed, and used IWB pages to capture and collect evidence of their changing understandings. Pupils reflected together on the shadow formation on the IWB and gave feedback to each other. Each learner's shadow representation is capable of being saved as a digital file by the teacher from the IWB or by the learners. These files serve as e-formative interim outcomes (within zones of proximal development of learners' understand-

ing in Vygotsky's terminology) and can be used for self or peer-assessment. Self- and peer-assessment might result in revision of ideas in the form of stable current understandings capable of being stored as digital records. Teachers were able to learn about pupil understanding by the ways pupils projected and drew hypothetical and real shadows on the IWB.

This was a rich case, in which the role of technology was significant in terms of it as a means of representing thinking over time. The relationship between 'representation of thinking/ understanding' and formative practices is explored within an holistic view on pedagogy, and has been explored extensively elsewhere by the case authors[1]. The project has collected a number of cases in which technology constitutes a 'representation' of thinking and we have prioritised one in which representation via image capture on mobile phones is the technological focus, and where there is less existing literature on its potential to contribute to formative assessment. The 'Shadows' case was not prioritised because the primary school context as an institutional setting is not a main focus for the current project, although there were aspects of practice here which relate to learning across the sectors.

The full case can be found at: http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Cases/Shadows

6.2.3 Personal Response System (PRS) (electronic voting)

There were many potential cases where electronic voting has contributed to formative assessment practices, several of which were recorded in literature based in the school sectors or overseas[2]. One rich case is set in a large mechanical engineering department which took part in the project 'Re-Engineering Assessment Practices' (REAP) in Scottish Higher Education aimed at large-enrolment first year courses across three universities[3]. The key driver was to enhance

1 E.g. McGuigan, L and Russell, T. (2004) Using multi-modal representations to promote conceptual change: theory and application to science classrooms. 4th European Symposium of the Special Interest Group on Conceptual Change of the European Association for Research on Learning and Instruction (EARLI), Cultural Centre of Delphi, Greece, May 19 to May 23, 2004.

2 E.g. Toothill, J (2005) Evaluating the contribution of Activote as a formative assessment tool ICT Test Bed Evaluation, Becta http://www.evaluation.icttestbed.org.uk/learning/research/primary/technology/interactive_voting_system

3 http://www.reap.ac.uk/

the student learning experience, and increase student retention by introducing PRS. The technology was used to enable active learning and teaching by questioning. To check students' understanding in class, carefully considered Multiple Choice Questions were asked which aimed to provoke difference of opinion in the students' individual responses. The tutor monitored the answers on the voting system, and then usually asked the class to work in groups to discuss their answers and defend their responses. This was usually followed by the lecturer telling the correct answer, followed by whole class discussion where individuals explain the thinking behind their answers. Motivation increased, as evidenced by increased class attendance, and results in diagnostic tests improved. There has clearly been an impact on pedagogy and this is linked to a more embedded approach to FA as an integral part of pedagogy.

It was felt that the REAP case of PRS was a well-developed and evidence-based example of formative assessment practices in which technology played a significant role. The project aims to develop
new cases of practice using technologies in this way, so this case and similar REAP studies have not been included here but can be accessed by the link given.

The full case can be found at: http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Cases/PersonalResponseSystemREAP

6.2.4 Click – Customized learning service for concept knowledge

High school students in the USA needed support to effectively use digital library resources for learning in Science, Technology, Engineering and Mathematics (STEM). Designers needed to understand what learners knew, what they should know, and be able to address the learners' incorrect, vague and missing conceptual knowledge with resources from the digital library. CLICK used student essays to generate the students' concept map of current understandings of relevant topics. Resources that were topic and age appropriate were selected from the digital library and used to generate the reference domain concept map. CLICK compared the concept maps, identified students' misconceptions and recommended resources from the digital library that could address the problems in flagged sentences in their essays. Student learning was accessed using behavioural and verbal data to address potential changes in learning processes and science understanding.

This case raised interesting questions regarding computer-generated 'solutions' and their impact on formative assessment. The case was not selected because

it was felt that the notion of 'delivery' of a student's concept map based on their essays was problematic in terms of students as actively engaged in formative assessment processes. Their actual engagement with their own learning, or state of meta-level awareness of their learning, was ambiguous. It was also unclear as to how the data collected about students' conceptual understanding contributed to modifications of pedagogy within a 'delivery' model of digital resource use.

The full case can be found at: http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Cases/CustomizedlearningserviceforconceptknowledgeCLICK

6.3 Patterns

6.3.1 Introduction

This section presents ten design patterns derived from the cases we analysed. Each pattern represents a typical process of formative assessment which could be supported by software tools. This list is neither comprehensive nor definitive, but it represents a broad sampling of the domain.

This section presents a sample of the design patterns in the domain of formative e-assessment we have produced. These patterns have been developed through a participatory process in and between workshops. Some of them where initially contributed by members of our user group, and then elaborated by their peers and by us. Some have been brought in from other groups or projects, when deemed appropriate for the discussion. As is expected in such a process, the outputs vary in maturity and style. Given the nature of this study as a scoping exercise, we chose to prioritise interest over formal academic rigour in the selection of samples to include in this report.

The full and most recent version of these patterns in available on the project on-line workspace at: http://purl.org/planet/Groups.FormativeEAssessment/Process+Models+&+Design+Patterns

All the patterns presented here include contributions from multiple authors. These are not noted here, but are listed on the website. We urge anyone interested in making further use of these patterns to consult the website for the definitive version and attribution details.

Patterns are by nature densely linked each other and to case stories. As a con-

vention, references to pattern names appear in Bold Small Caps and references to cases are **bold underlined**.

Most of our patterns pertain to the design of interactive spaces for learning. Narrative Spaces, Objects to Talk With, Classroom Display and Wear Your Skills refer to the design of collaborative or conversational spaces, whereas Soft Scaffolding is relevant to individual learning as well. Other patterns relate to the design of activities, which could be implemented in either physical or virtual environments. These include Use My Stuff, Feedback On Feedback, Round and Deep, Showcase Learning and Try Once Refine Once. The Three Hats pattern which appears in the methodology section is also in this class.

Classroom Display	Share learners' work with a trusted audience. Create a space within the learning environment where learners' works can by displayed side by side.
Feedback on Feedback	Feedback given to learners should provide opportunities to improve the learning experience. It should comprise constructive feedback to improve learning as well as socio-emotive feedback. Tutors in large courses often resort to grading devoid of effective feedback. To support them in improving their feedback, they need effective feedback on the feedback they give.
Narrative Spaces	Constructing narrative is a fundamental mechanism for making sense of events and observations. To leverage it, we must give learners opportunities to express themselves in narrative form.
Objects to Talk With	When we talk we point at objects. When we talk on-line we should be able to do so too. When providing tools for learners to discuss their experience, either as part of the activity or at a reflective meta-level, allow them to easily include these artefacts in the scope of their discussion.

Round and Deep	Use the students' experiences to complement your own and provide the alternative perspectives required.
Shocase Learning	Publicly celebrate student work.
Soft Scaffolding	Scaffolding is a term commonly used in educational design to describe structure that directs the learner's experience along an effective path of learning. Technology should be designed to scaffold learners' progress, but an interface that is too rigid impedes individual expression, exploration and innovation.
Try Once, Refine Once	A two-step question-answering system which encourages students to consider their initial answers to skills-based questions very carefully, and, on receiving feedback on their errors, to give as much thought to the refinement process.
Wear Your Skills on Your Shirt	Use virtual appearance to reflect abilities. The visual representation of your avatar shows the extent of your skills. Skills can be gained or given, and be personal skills or avatar skill.
Use My Stuff	Use learner supplied artefacts as raw materials for new learning activities.

6.3.2 *Classroom display*

http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Patterns/Classroomdisplay

Summary
Share your work with a trusted audience.

Problem
Using learners' work as part of the instructional activity has several advantages, it:

- Rewards participation.
- Makes learning more meaningful, by relating it to learner's personal experiences.
- Allows the teacher to align instruction with students' perspective and current state of knowledge.

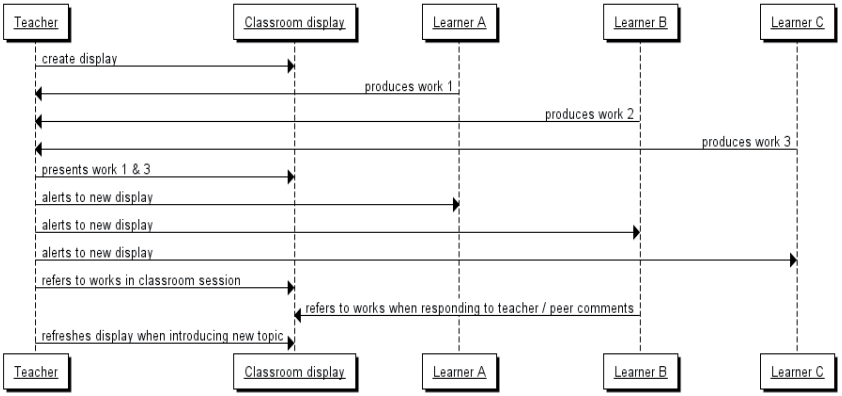
However, doing this poses some challenges:

- The teacher needs to have learners' works collated in a single easy to access location, so that she can draw on them as needed.
- Learners may feel uncomfortable about presenting their work in a public space.
- There may be legal or other restrictions on sharing work.

Context
Most suited for small to medium size classes, blended learning, not one-off, where learning has an element of production / construction of visual artefacts. However, could be adapted and extended to a very wide range of settings.

Solution
Create a space within the learning environment where learners' works can by displayed side by side.
Works can be arranged thematically, chronologically, as an index or as a Visual Narrative.
The size and location of the display should allow learners and teacher to view a collection of learners' work simultaneously, and refer to them in the course of the learning activity.
The display should be visible for all learners, but may need to be concealed from the outer world. If not, it should as least function as a Front Garden.

(diagram generated using http://www.websequencediagrams.com)



Related Patterns
Extends: USE MY STUFF, OBJECTS TO TALK WITH, TRUSTED AUDIENCE
Uses: PAPER20
Contrasts: SHOWCASE LEARNING

Support
Source
Como: mobiles + flickr = co-reflective practice

Triangulation (additional supporting cases)

- Streaming Theatre
- Programming Puzzles in Second Life

Rationale (theoretical justification)
In terms of learning theory, this pattern links with well-established co-constructivist theories by which learners build knowledge by pooling their individual knowledge resources, making these available for others and working collaboratively to augment existing ideas and understandings. Formative processes here are essentially socio-interactive, related to the types of exchange which take place around the 'signs' between learners and between teachers and learners. Such theories have origins in Vygotskian perspectives on the socio-psychological aspects of learning within social contexts as negotiating meanings. This work is premised on the need to interpret 'signs' (words but can also be images, diagrams – all forms of 'representation' – see Jewitt and Kress (2003) by which in-

dividuals represent internal conceptualizations. Making learners' work the explicit focus of shared learning approaches formalizes a core learning process which involves the teacher and peers in negotiating meanings. An important formative assessment aspect of the pattern is also the suggestion that the teacher modifies pedagogy in response to learning about the students' current state: 'Allows the teacher to align instruction with students' perspective and current state of knowledge'

6.3.3 Feedback on feedback

Summary
Feedback given to learners should provide opportunities to improve the learning experience. It should comprise constructive feedback to improve learning as well as socio-emotive feedback. Tutors in large courses often resort to grading devoid of effective feedback. To support them in improving their feedback, they need effective feedback on the feedback they give.

Problem
Effective feedback needs to:

1. Alert learners to their weaknesses.
2. Diagnose the causes and dynamics of these.
3. Include operational suggestions for opportunities to improve the learning experience.
4. Address as socio-emotive factors.

Tutors may be aware of all these, but still need guidance in structuring their feedback. Often, for lack of knowledge or limited resources, they may resort to feedback which only covers the first requirement. In order to improve tutor feedback, they need to be provided effective feedback on the feedback they give. This should be provided as close as possible to the event, in order to allow them to adapt their strategies and recover from their mistakes. However, in large courses with many tutors, this is a challenge.

Context
- Large scale, technology supported, graded courses: many tutors instructing many students.
- Tutors need support in providing effective feedback, but resources for individual mentoring are not available.
- Feedback is mediated by technology that allows it to be captured and processed in real time (this requirement can be relaxed).
- Topic of study is subject to both grading and formative feedback.

Solution
Embed a mechanism in the learning and teaching system that regularly captures tutor feedback, analyses it, and presents them with graphical representa-

tion of the types of feedback they have given. Ideally, this should also include constructive advice as to how to shift from less to more effective forms.

In computer-supported environments (e.g. VLEs), this mechanism could be integrated into the system, providing tutors with immediate analysis of their feedback, as well as long-term aggregates.

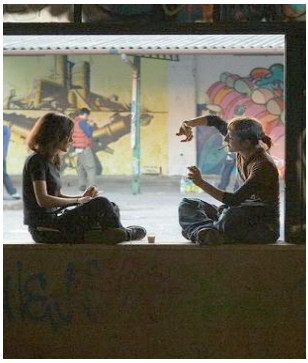
In unmediated environments (e.g. frontal classrooms), the same mechanism can be implemented by cross-observations between tutors, using a printed feedback tracking form.

Support
Source
Open Mentor

Triangulation (additional supporting cases)

- Open Comment
- Developing Formative Assessment for H812: Postgraduate Certificate in Academic Practice
- AA308 Case Study: Experiences of a course team producing formative e-assessment for the first time

Rationale (theoretical justification)
Black et al (2003) (applied formative assessment strategies in school settings).
'An assessment activity can help learning if it provides information to be used as feedback by teachers, and by their students in assessing themselves and each other, to modify the teaching and learning activities in which they are engaged. Such assessment becomes formative assessment when the evidence is used to adapt the teaching work to meet learning needs' (p. 2). The focus on teacher adaptation of pedagogy is one criterion of formative assessment which emphasises a potentially long cycle of teacher learning which impacts on student learning, as well as 'immediacy' for some learning contexts. There may be limited or no immediate gains for learners in some contexts, where teacher learning needs to adapt to more complex types of change. Although 'immediacy' features in the 'moments of contingency' in this pattern (Black and Wiliam, forthcoming), what is 'contingent' may also have longer-term developmental consequences for pedagogy. Both 'immediacy' and 'long- or medium-term change' can be achieved in this pattern.



6.3.4 Narrative Spaces

http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Patterns/Narrativespaces

Summary
Constructing narrative is a fundamental mechanism for making sense of events and observations. To leverage it, we must give learners opportunities to express themselves in narrative form.

Problem
Narrative is a powerful cognitive and epistemological construct (Bruner 1986; 1990).
Science and Mathematics appear to be antithetical to narrative form, which is always personal, contextual and time-bound.

Context
Digital environments for collaborative learning.

Solution
Provide learners with a narrative space: a medium, integrated with the activity design, which allows learners to express and explore ideas in a narrative form:

- Allow for free-form text, e.g. by supporting soft scaffolding.
- Choose narrative representations when possible.

Mark narrative elements in the medium:

- Clearly mark the speaker / author, to support a sense of voice.
- Date contributions to support temporal sequentiality ('plot').
- Use semi-automated meta-data to provide context.

Related Patterns
Used by: Guess My X, Three Hats, Round And Deep and others
Assisted: Objects To Talk With, Visual Narrative

Support
Souce
Number sequence activities in WebLabs

Triangulation (additional supporting cases)

- Streaming Theatre
- Blogging4Educators
- Architecture 4 Participatory Learning workshop, Singapore, Aug. 2008
- PED 2
- How to write a story

Rationale (theoretical justification)
In terms of the Conversational Framework (Laurillard 2002) this pattern relates to the aspect of 'the learner's conception as practice'.

In terms of Black and Wiliam's (2009) theory of formative feedback, this is an example of key strategy 2 'Engineering effective classroom discussion and other learning tasks that elicit evidence of student understanding.'

Bruner (1986) has made a strong argument for the role of narrative thought in learning:

> "There are two modes of cognitive functioning, two modes of thought, each providing distinctive ways of ordering experience, of constructing reality. The two (though complementary) are irreducible: to one another. Efforts to reduce one mode to the other or to ignore one at the expense of the other inevitably fail to capture the rich diversity of thought.
>
> Each of the ways of knowing, moreover, has operating principles of its own and its own criteria of well-formedness. They differ radically in their procedures for verification. A good story and a well-formed argument are different natural kinds. Both can be used as means for convincing another. Yet what they convince of is fundamentally different: arguments convince. One of their truth, stories of their lifelikeness. The one verifies by eventual appeal to procedures for establishing formal and empirical proof. The other establishes not truth but verisimilitude."

6.3.5 Objects to talk with

http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Patterns/ObjectsToTalkWith

Summary
When we talk we point at objects. When we talk online we should be able to do so too.

Problem
Natural, face to face, discourse makes extensive use of physical artefacts: we gesture towards objects that mediate the activity to which the discussion refers. This dimension of human interaction is often lost in computerized interfaces.

Context
This pattern is relevant to computerized interfaces which allow learners to converse about a common activity.

Solution
Learning activities involve the use or construction of artefacts. When providing tools for learners to discuss their experience, either as part of the activity or at a reflective meta-level, allow them to easily include these artefacts in the scope of their discussion. If the activity is mediated by or aims to produce digital artefacts, then the discussion medium should allow embedding of these artefacts. Whatever the nature of the objects, the medium should support a visual (graphical, symbolic, animated or simulated) 1:1 representation of these objects.

Related Patterns
Adapted from: http://lp.noe-kaleidoscope.org/outcomes/patterns/Objects_to_talk_with/

Support
Source
Como: mobiles + flickr = co-reflective practice

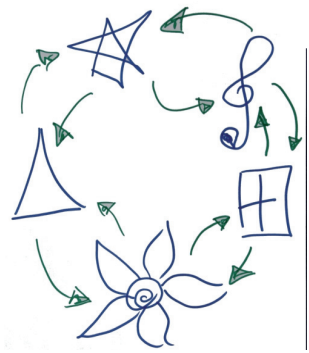
Triangulation (additional supporting cases)
- PED 2
- Vet students recording and reflecting on clinical experiences using mobile image capture

Rationale (theoretical justification)
In terms of the Conversational Framework (Laurillard 2002) this pattern relates to the learners activities in interaction with one another at the discursive level.

In terms of Black and Wiliam's (forthcoming) theory of formative feedback, this is an example of key strategy 4 'Activating students as instructional resources for one another'.

Ackermann (2007) in her paper 'Experiences of artefacts' discusses interaction with existing artefacts in terms of Piaget's concepts of assimilation (of the experience of the artefacts into one's own internal mental structures) and accommodation (of internal mental structures in response to the interaction with the artefact). The two processes for Piaget forming part of the adaptation process. Ackerman's discussion relates both to existing artefacts and those that are created by the learner as part of the learning process.

This use of the creation of artefacts as part of the learning process is a fundamental aspect of constructionism (Papert and Harel,1991).



6.3.6 *Round and deep*

Pattern contributed by Helen Sharp, Open University
http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Patterns/RoundAndDeep

Summary
Use the students' experiences to complement your own and provide the alternative perspectives required.

Problem
You want the whole class to benefit from the experiences of individual students in your class.

Context
An experienced student is likely to gain a deep understanding of a complex concept by relating it to his or her own experience. But the same experience which results in a deep understanding may also limit it because a rounded understanding of a complex concept can only be achieved by considering different perspectives. To gain a deep understanding of a complex concept, the student needs to consider it from many different perspectives, but your own experience is necessarily limited and a classroom exercise (in a University or Industrial setting) is necessarily too simple to cover adequately the deep issues surrounding the concept. Experienced students will relate a new concept to their own real-world experiences, and will form a deep understanding of it, but if their experience does not validate the concept, then its significance may be lost, and if their experience does validate the concept then although understanding may appear deep, it may also be narrow.

Solution
Therefore, use the students' experiences to complement your own and provide the alternative perspectives required.

This can be achieved through group (preferably) or individual activity which exercises the concept from a number of perspectives, followed by presentations and discussion to exchange ideas, concerns, lessons learned and so on. Asking students to present findings to you and to fellow students compels them to clarify their own thought. This in itself can deepen the student's own understanding, while the presentations and discussions deepens the collective understanding of the class by sharing other students' experiences, misconceptions and break-

throughs. How well this pattern works depends on how many and how varied are the experiences in your class and how prepared the students are to expose their understanding of the concept. Some perspectives may conflict, but good learning experience will emerge from their resolution and compromise. You will also learn quite a lot and broaden your understanding!

Related Patterns
This pattern is part of the Teaching from Different Perspectives pattern language, developed by the pedagogical patterns project.

Support
Source
This pattern and its related pattern language are derived from the Pedagogical Patterns Project (http://pedagogicalpatterns.org/). This website is a little out of date but the pattern languages published there have been shepherded through several Patterns conferences (in the Pattern Languages of Programs [PLoP] series).

This pattern has appeared in "Teaching from Different Perspectives" (Eckstein, Manns, Sharp and Sipos, 2003).

Rationale (theoretical justification)
In terms of the Conversational Framework (Laurillard, 2002; 2008) this pattern relates to the discussion between students leading to the development of learners' conceptions.

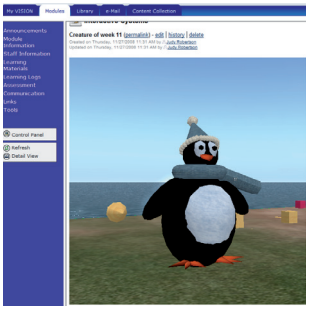
In terms of Black and Wiliam's (forthcoming) theory of formative feedback, this is an example of key strategy 4: activating students as instructional resources for one another.

General theories of cooperative learning are well developed: "There are at least three general theoretical perspectives that have guided research on cooperative learning. The most influential is social interdependence theory, whose roots extend from Kurt Koffka in the early 1900s to Kurt Lewin and Morton Deutsch in the mid-1900s, to the authors of this article. Its central proposition is that the way social interdependence is structured determines how individuals interact with each other which, in turn, determines outcomes. Positive interdependence (cooperation) creates promotive interaction, negative interdependence (competition) creates oppositional interaction, and no interdependence (individualistic efforts) results in an absence of interaction. From the theories of Piaget and Vygotsky comes the cognitive development theory, with the proposition that

when individuals cooperate, socio-cognitive conflict occurs that creates cognitive disequilibrium, which in turn stimulates perspective-taking ability and cognitive development. Both the work on structuring academic controversies and research on cognitive restructuring are drawn from this orientation. Based on the work of Skinner, Bandura, Homans, Thibaut and Kelly, and more recently, Slavin, behavioral learning theory focuses on the impact of group contingencies on learning; its main proposition is that actions followed by extrinsic rewards will be repeated." (Johnson & Johnson 1993) (taken from http://www.ukcle.ac.uk/resources/temp/assessment.html).

There may be work in Work based learning that could add specific support for the importance of the kind of perspectives sharing being suggested here.

It is however important to define how this process will be carried out as there are a range of approaches in the literature that could be applied to implementing such a pattern.



6.3.7 *Showcase Learning*

Pattern contributed by Judy Robertson, Heriot Watt University, Edinburgh
http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Patterns/ShowCaseLearning

Summary
Publicly celebrate student work.

Problem
Often in university settings, learning is hidden behind closed classroom doors, stored in private file spaces, or locked away in a VLE. In contrast, primary school learning environments celebrate their students' work by literally papering the walls with it, creating a more motivating and fun environment for teachers, learners and visitors. This pattern is about celebrating student learning in university spaces, either digitally or physically. It shows the students that we value good work, and they should be proud of it. Issues which should be considered [or forces operating on this problem?] are privacy and inclusion. Parameters to using the pattern include the mixture of technologies used, who selects the content, the duration of the display, and the size of audience with whom you wish to share the students' work.

Context
You could use this pattern in these contexts:

- university learners (undergraduate)
- in conjunction with learning technology such as a VLE/ Second Life, blogs

It works within computer science, and physical versions of this pattern are common in art or design schools. [Comments from people in other disciplines?]

Solution
There are a number of parameters which you can use to customise this pattern to your situation.

- Technology mixture: at one end of the spectrum you could make a paper "good work" board to hang on the wall of your teaching space. At the other end you could have a dynamic display of digital content on the university web space. Or you could have a digital display on physical screens in the university department, for example in social spaces or as screen savers in

computer labs.

- Content selection: Who has ownership of this system? Do you want it to be staff lead as a way of modelling good work and encouraging students to emulate it? Or do you want it to be student led, where students have responsibility for selecting, filtering and maintaining content for their peers? This would be suitable for encouraging a student sense of community.
- Context of display: where will it take place, and for how long? Options include a quick demo of student work in a lecture, pointing out good work in the lab, making a display for a class wall which lasts for a semester or a more permanent display for a a department exhibition space.
- Medium: What will you display and how will it be presented? Will it be an oral presentation by students? Will it be photos or screen shots of student work? Written work? Physical artefacts?
- Audience size: The least threatening for students is displaying to a small group of friends within the class. The most stressful is likely to be a public display (such as a degree show). Points on the continuum include displaying something to the whole class, or showing work within the walls of the department.

Examples

1. End of term showcase in which prizes are given for peer nominated work, nominated students present their work, and the staff give a prize to the best.
2. "Star of the week" when a lecturer mentions a student who did good lab work during the week in a lecture, pointing out what they have done well.
3. Departmental web pages which show excerpts from work of current students.

Issues to consider

There are a couple of issues to be aware of when working with this pattern: inclusion and privacy.

Consider the issue of inclusion: you want to celebrate students' work, but what does this mean for the students whose work is not showcased? They will perhaps feel left out or undervalued, or resent those whose work is shown. You could address this partly by taking care how you select the content for the showcase. Will you select only the best work? Or will you show work where the student has improved their own work recently? Or will you select work where students demonstrate attributes or skills like good problem solving, patience, or the willingness to help others? It is certainly important to establish with the students an atmos-

phere where they have positive feedback from the staff anyway, to reduce the feeling that their work is not good. Another approach is to invite students to peer nominate content as other students may be more aware of their classmate's good efforts than the staff, depending on the class size.

What about privacy? When selecting content, you need to think about whether the students will react well to having their work displayed. You want to create a safe classroom environment where the students feel encouraged but not pressured. Students may feel stressed if they have to verbally present work within a large class, but may feel more relaxed if their work is shown on a display. For example, I once had a student with a social phobia who was very distressed at the thought of his work being peer nominated for a verbal presentation in class. They are more likely to feel worried when presenting outside the class group to visitors or other year groups of students. You might want to consider whether you need to get the students to sign consent forms if the work is to be shown in a very public place for a considerable length of time. (For example, one of my computer science students suspects the university of wanting to hoard his intellectual property and is wary of having his software displayed on university web space)

Related Patterns
Uses the GOLD STAR teaching pattern: http://pclc.pace.edu/~bergin/PedPat1.3.html#goldstar

Support
Source
Creature of the week

Rationale (theoretical justification)
In terms of Black and Wiliam's (forthcoming) theory of formative feedback, the visualisation of processes attendant to learning fits into the notion of contingency: the conceptual understanding of learners is made tangible and interrogable, normally through processes of reflection and meta-reflection, and opportunities are created for both teacher and learner to take action and make deliberate decisions. In terms of the Conversational Framework (Laurillard 2002) this pattern relates to bridging the gap between the learner's and the teacher's conceptions: visual representations externalise the learner's conception and provide a basis for learning conversations between the learner, teacher and peers to take place. This pattern contains several features which potentially meet Nicol's (2007) 'principles':

- encourages positive motivational beliefs and self-esteem

- encourage interaction and dialogue around learning
- facilitate the development of self-assessment and reflection in learning
- help teachers adapt teaching to student needs.

In relation to Webb and Cox (2007), the pattern addresses the first two principles:

- to start from where the learner is and recognising that students have to be active in reconstructing and formulating their ideas; to obtain feedback from individual students to determine what their existing ideas are
- for students to be active and for teachers to encourage, and listen carefully to a range of responses.

Notes, Links and References

See http://judyrobertson.typepad.com/judy_robertson/2008/07/windows-onto-le.html?cid=129920726 for a fuller explanation.

6.3.8 Soft scaffolding

http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Patterns/SoftScaffolding

Summary
Scaffolding is a term commonly used in educational design to describe structure that directs the learner's experience along an effective path of learning.

Technology should be designed to scaffold learners' progress, but an interface that is too rigid impedes individual expression, exploration and innovation.

Problem
Scaffolding is a powerful tool for learning. It is a fundamental principle in many interactive learning environments, such as OISE's Knowledge Forum, and is a guiding principle in Learner-centred approaches (c.f. Quintana et al, 2004). However, scaffolds can become straitjackets when they are too directive.

Forces

- The role of the educator, and by extension educational tools, is to direct the learner towards a productive path or enquiry.
- If the educational tool adamantly leads the learner through a set sequence, it risks failure on several accounts:

    - There is no leeway for mistakes, innovations, explorations or personal trajectories of learning.
    - Learners feel deprived of personal voice, and their motivation may falter.
    - It is hard to bypass design flaws discovered in the field or adjust to changing circumstances.

Adapted from:
http://lp.noe-kaleidoscope.org/outcomes/patterns/Soft_scaffolding/

Context
Derived from interactive web-based interfaces, where users can express themselves in writing. However, it should apply to almost any interactive learning interface.

Solution
Provide scaffolding which can easily be overridden by the learner or by the instructor. Let the scaffolding be a guideline, a recommendation which is easier to follow than not, but leave the choice in the hands of the learner. For example:

- When providing a multiple-selection interface, always include an open choice, which the user can specify (select 'other' and fill in text box).
- When the user is about to stray off the desired path of activity, warn her, ask for confirmation, but do not block her.

Related Patterns
NARRATIVE SPACES and ACTIVE WORKSHEET

Support
Source
Number sequence activities in WebLabs

Rationale (theoretical justification)
In terms of the Conversational Framework (Laurillard 2002) this pattern relates to the teacher's activity 'Adapt a Task practice environment for learners' needs'.

In terms of Black and Wiliam's (forthcoming) theory of formative feedback, this is an example of key strategy 3 'Providing feedback that moves learners forward'.

The concept of scaffolding is a well established one in educational theory (Wood, Bruner and Ross, 1976). However the precise nature of what constitutes scaffolding has given rise to some discussion. Wood and Middleton (1975) argued that in their study "Successful post-tutoring task activity correlated highly with the extent to which each of the tutor's actions reflected the nature of the learner's immediately preceding activity" pointing to the importance of connecting the scaffolding with the individuals learner's activity.

In recent years the use of 'scripts' as forms of scaffolding in computer supported collaborative learning has become popular, but the rigidity of these scripts makes them unable to connect with the individual learner's preceding activity, and it is this rigidity that the present pattern attempts to break away from. Wood (2001) presents an interesting discussion of the concept of scaffolding within the context intelligent tutoring systems.

Notes, Links and References
The forces of this pattern are present in face-to-face learning situations.

Experienced educators resolve them by providing adaptive support; varying the learners freedom in response to their confidence. This could be implemented by intelligent tutoring systems, but simple learning environments lack this flexibility, and tend to compensate by being over-directive.

6.3.9 *Try once, refine once*

http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Patterns/TryOnceRefineOnce

Summary

A two-step question-answering system which encourages students to consider their initial answers to skills-based questions very carefully, and, on receiving feedback on their errors, to give as much thought to the refinement process.

Problem

Large numbers of students on a skills-based course. Lack of immediate feedback for students leads to fossilisation of errors and misconceptions - however providing immediate feedback in an iterative fashion can also hinder effective learning since students are able to "grope their way" step-by-step to a correct solution without necessarily having to think about each answer as a whole.

Context

Skills-based learning situations where multiple misconceptions in exercise answers are possible. Particularly applicable to foreign language learning, but should also work for other skills-based fields. The range of assessment types this approach might be suitable for would be those in which student answers can contain multiple errors, for which detailed feedback indicating the source and type of each of the errors can be generated/given, without revealing exactly what must be done to correct them.

Solution

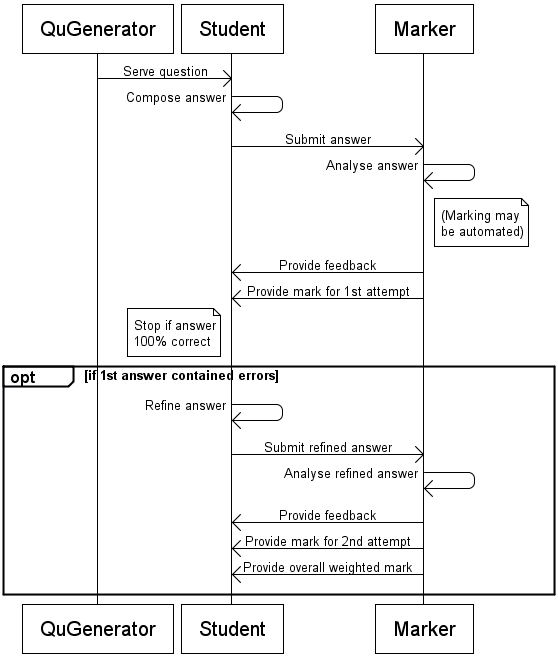
Students are posed questions of a type which elicit answers that can contain multiple errors. If a student's answer is entirely correct a mark of 100% is awarded. If their answer contains errors, a mark is given which contributes to a percentage of the total mark for the question, along with detailed - yet generic- feedback on the location and type of the errors. Students are then permitted a second attempt in which to refine their answer. The mark for the 2nd attempt contributes to remaining percentage of the total mark for the question. Feedback on any remaining errors is also given, along with the correct answer(s). No further attempts are permitted.

The two-attempt limit and unequal weighting of the marks for the initial attempt and the refined answer are crucial to this pattern, since they prevent students from adopting a mindless iterative approach, in which they begin with a "stab-in-the-dark", then allow the system/tutor to guide them step-by-step to the correct answer (often via numerous minimally-altered attempts).

The marks ratio can vary, but showing a distinct favouring for the first attempt works best - ensuring that students give careful consideration to all components of their first answer, and equally careful consideration to improving it in the face of the diagnostic feedback. If the ratio is skewed too far in favour of the second attempt then students tend to exhibit less care over the construction of their initial answer. If the ratio is skewed too far in favour of the first attempt then students are less inclined to try and correct non-perfect answers.

The marks ratio could be adjusted according to the amount of information in the feedback. The less information in the feedback the higher the second mark should be, the more information in the feedback the less the second mark should be.

(Sequence diagram from http://www.websequencediagrams.com/)



Related Patterns
Most closely related, from Fourteen Pedagogical Patterns (Bergin, 2000)
GRADE IT AGAIN SAM

Support
Source
String comparison in language learning

Triangulation (additional supporting cases)
Post 16 string comparison

Rationale (theoretical justification)
In terms of the Conversational Framework (Laurillard 2002) we see here the learner's action to achieve task goals, feedback on action, and reflection on feedback leading to a change in the learner's conception. The Conversational Framework provides no specific justification for the division of marks or form of feedback.

In terms of Black and Wiliam's (forthcoming) theory of formative feedback, this is an example of key strategy 5, activating students as the owners of their own learning.

A particular clue as to why the assessment regime proposed in this pattern might work is provided in Hattie and Timperley (2007) who write: "The degree of confidence that students have in the correctness of responses can affect receptivity to and seeking of feedback. Kulhavy and Stock (1989) noted that if confidence or response certainty is high and the response turns out to be a correct one, little attention is paid to the feedback. Feedback has its greatest effect when a learner expects a response to be correct and it turns out to be wrong. As Kulhavy and Stock noted, "high confidence errors are the point at which feedback should play its greatest corrective role, simply because the person studies the item longer in an attempt to correct the misconception" (p. 225)." Because 75% of the marks will be given for the first attempt the students are likely to give answers in which they have a considerable degree of confidence – so, if the answer is then found to be incorrect, then this is a situation where the feedback will be most effective.

This pattern contains several features which meet Nicol and Macfarlane-Dick's (2006) 'principles' of good feedback as core to the 'source of formative assessment', which enables learners to 'make evaluative judgements about their own work' (Nicol, 2007). In the argument made by Nicol and Macfarlane, learner

self-regulation is fundamental within formative processes. This pattern meets the following 'principles' by which learner self-regulation is achieved (not all 7 principles will be met equally in all contexts - these are the 5 significant ones here):

- helps clarify what good performance is
- facilitates the development of self-assessment and reflection
- delivers high quality info to students about their learning
- encourages positive motivational beliefs and self-esteem
- provides opportunities to close the gap between current and desired performance

Notes, Links and References
In the CALL exercises from which this pattern was drawn, the ratio of marks between the first and second answer attempts was 3:1. This proved optimal for the original situation but is obviously easily altered for other assessment types. The "try once, refine once" approach led not only to marked improvements between first and second answer-attempts, but more importantly to demonstrable improvement in accuracy (and speed) of answering as users progressed through exercises. In other words, students became able to formulate their foreign language sentences more accurately and with greater rapidity, which is a good measure of success in language learning.

It should be noted that the CALL questions (English sentences to translate) were generated randomly and students could do each exercise in a single sitting or in multiple sittings over the course of several weeks. Thus it was not the case that improvements were down to question-ordering or the effects of short-term memory. Furthermore sentence-types could be fairly complex, and students had to attempt to get all aspects of a sentence correct, so it was not simply a matter of concentrating on a single grammatical aspect such as verb endings.

It is also worth mentioning that students often chose to do far more than the minimum number of questions per exercise than they were obliged to do, because they found the system helpful and were aware that they were improving by using it.

- Providing effective feedback on whole-phrase input in computer-assisted language learning. ***Alison M. L. Fowler***. In Farzana Khandia, editor, Proceedings of the 12th International Computer Assisted Assessment Conference 2008, pages 137-150, Professional Development, Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK, July 2008. Loughborough University, Professional Development.

- Logging student answer data in call exercises to gauge feedback efficacy. ***Alison M. L. Fowler***. In Jozef Colpaert, Wilfried Decoo, Saskia van Beuren, and Aline Godfroid, editors, CALL & Monitoring the Learner - Proceeedings of the 12th International CALL Conference, pages 83-91, Universiteit Antwerpen, Universiteitsplein 1, B-2610 Wilrijk, Antwerpen, Belgium, August 2006. LINGUAPOLIS, Universiteit Antwerpen.

6.3.10 Wear Your Skills on Your Shirt

Contributed by Nicole Schadewitz, Open University
http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Patterns/WearYourSkills

Summary
Your appearance reflects on your abilities.

Problem
Potential collaborators need to know about each others skills and abilities to complete a certain task. The aim of this pattern is baselining skills among potential partners before a task in approached together.

One way this can be achieved is by representing yourself and your abilities using your abilities (to represent yourself.

Context
- visual virtual worlds
- virtual collaborative environment that allow a visual representation of yourself
- community environments that offer customization of home pages for individual users or user groups
- non-anonymous users

Solution
The visual representation of your avatar shows the extent of your skills. Skills can be gained or given, and be personal skills or avatar skill.

Related Patterns
Extends (elaborates):
Baseline Skills and Collaboration Follows Identity

Support
Source
Flash meeting Design Collaboration

Rationale (theoretical justification)
In terms of the Conversational Framework (Laurillard 2002) this pattern relates to the activity of learners presenting their own conceptions.

In terms of Black and Wiliam's (2009) theory of formative feedback, this is an example of key strategy 5 'Activating students as the owners of their own learning'. There is a clear link between this pattern and ideas about self- assessment which form an important element of Black and Wiliam's account of formative evaluation, as well as theories of self- regulated learning. It is reflected in the 6th of Nicol's Ten Principles of Good Assessment and Feedback Practice namely 'Facilitate the development of self-assessment and reflection in learning' Nicol (2007), which are themselves initially derived from a consideration of self- regulated learning.

Boud (2000) develops the concept of sustainable assessment to argue the importance of learners developing self-assessment in order to support lifelong learning.

6.3.11 Use my stuff

Contributed by Christian Kohls and Steven Warburton
http://patternlanguagenetwork.myxwiki.org/xwiki/bin/view/Patterns/UseMyStuff

Summary
Use learner supplied artefacts as raw materials for new learning activities.

Problem
As a trainer or teacher you want to bring together small groups of learners and create a coherent and meaningful training/learning experience. You need to understand the needs of the learners. The learners need to understand why they need the skills and how they apply to their daily work based activities. But often learners are not motivated by the learning examples being used.

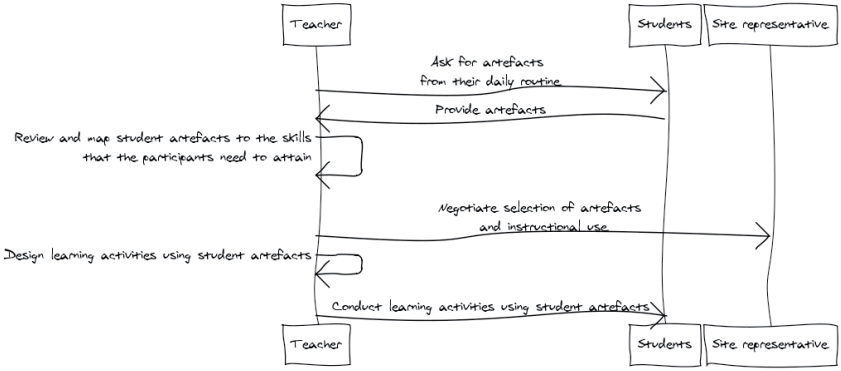
Context
This applies particularly to work-based training or Continuing Professional Development (CPD), where people are using 'tools' to create artefacts in their daily routines. The tool (from the training perspective) is not domain specific e.g. Photoshop. It also works with less vocational courses where students are demonstrating generic or tool-based skills.

Solution
Get learners to contribute materials from their work or areas of interest and negotiate use of these in demonstrations and assignments, so that they are more motivated to engage.

One example of this is in work-based learning:

- Ask participants to provide a range of artefacts or source material from their daily routine and things they are planning or interests.
- Artefacts may be iterated by holding a workshop with the participants
- Review and map the artefacts to the skills that the participants need to attain in a process of negotiation of these learning goals with the key players (participants and the organisation as appropriate)
- Design demonstrations and assignments for training

(Diagram in following page from: http://www.websequencediagrams.com/)



Another example was seen in CETL ALiC in an Information Handling module. A previous prescriptive assessment was replaced by inviting students to create a video tutorial on a subject of interest to them. Subjects were proposed by the students and approved by the tutor at each stage in the assessment. The difference here is that the student's assessment is adjusted rather than the training materials.

Related Patterns

ROUND AND DEEP, CLASSROOM DISPLAY, SHOWCASE LEARNING

Rationale (theoretical justification)

Working with 'ordinary' artefacts from the workplace as a source of CPD or professional learning is an idea proposed by Eraut (2000) in his theorization of informal learning and tacit knowledge in professional work. Eraut insists that tacit knowledge is 'central to important, everyday action' of professional practice, but can be difficult to elicit and to know its value. The 'capability to tell' (Eraut , 2000, p. 17) is central to formative processes which centre on working with such things as artefacts as part of professional education. This capability is vital to 'meta-learning'. Eraut's research (2000) argues that people are able to talk 'more explicitly' about their knowledge at work when a 'mediating object' or representation of it is used as a catalyst within the learning process. Eliciting talk about 'what lies beneath' is vital to this process and is implied in this pattern.

A related example was used in CETL Active Learning in Computing (ALiC) where students were asked to create teaching resources about an interest and create a video of it.

Notes, Links and References
Takes time therefore an issue of scale is present in this pattern.

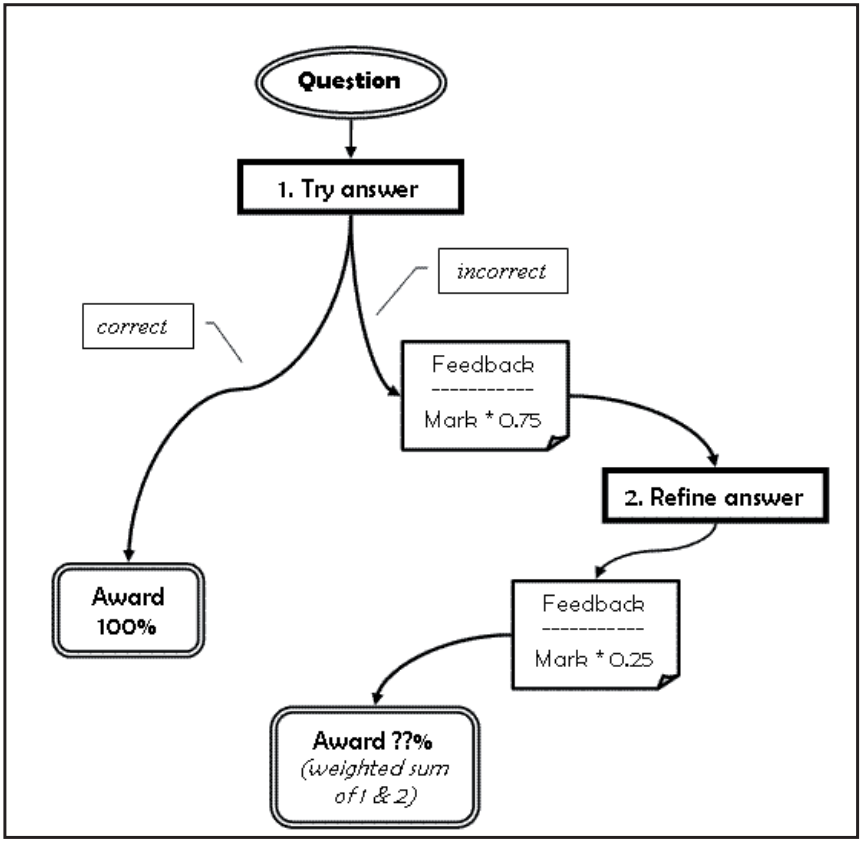
Participants may bring sensitive artefacts with them (for example we may find proto-type designs or similar).

6.4 Example scenarios

A scenario is a description of a speculative event, describing a problem / issue / desired function in a well-defined context, and a possible manner of addressing it. It is similar to a case study, except that it deals with an anticipated or speculative future event, rather than looks back on an actual one. During the project both tutors and software developers were asked to create possible scenarios and we describe here one example developed by each group.

6.4.1 Tutor-originated

Situation
The setting for this scenario is any teaching situation in which some students are able to succeed completely at the task set.



Task
In these teaching situations the students who do very well on the tasks typically receive very little in the way of formative assessment or feedback, beyond perhaps a 'Well done', whilst their colleagues who do less well receive significant feedback.

This problem can be seen as potentially arising from the use of TRY ONCE, REFINE ONCE pattern (that is it could be seen as a potential 'liability' in the pattern) where the correct answer leads to a mark of 100% and no feedback, whereas an incorrect answer leads to feedback.

The tutors wished to provide feedback for those who succeed.

Patterns
There are two aspects to the proposed solution, and the tutors identified one pattern for each aspect:

- Providing feedback to those who achieve well – using the pattern SHOWCASE LEARNING
- Helping tutors to adopt such feedback practices – using the pattern FEEDBACK ON FEEDBACK

Solution
The pattern SHOWCASE LEARNING could be used to celebrate students' work; this will enable examples of good work to be seen and to receive feedback from peers and tutors.

The training of tutors to provide appropriate feedback in this context can be provided by using the pattern FEEDBACK ON FEEDBACK in which tutors receive feedback on the feedback that they give to students, thus helping them to identify appropriate types of feedback in this particular context.

6.4.2 Developer-originated

Situation
First year undergraduate students starting a new subject in large classes (around 600) supported by small tutorial groups (6-12 students), taught on campus and with access to a VLE.

Task
A number of such courses require that students learn large new vocabularies

quite quickly. Two contrasting examples would be biology where students are expected to master a large number of unfamiliar terms, and philosophy where students are expected to master the specific technical meanings of perhaps well-known words and phrases. Formative assessment has potentially an important role in the learning of these vocabularies.

Patterns

- The developers identified four patterns which could inform a solution:
- NARRATIVE SPACES – giving students opportunities to express themselves in narrative form.
- OBJECTS TO TALK WITH – online representation of constructed artefacts.
- CLASSROOM DISPLAY – students sharing work with a trusted audience.
- SHOWCASE LEARNING - publically celebrating student's work.

(Interesting there are no patterns in the project at the moment directly dealing with voting, this is clearly an area for development.)

Solution

Students would build up their own personal glossaries, individually typing in the words and their own definitions, illustrating use in context, and then come together to share these definitions. This is an application of the NARRATIVE SPACES pattern giving learners opportunities to express themselves in narrative form, supporting the use of the vocabularies in context, and then bringing them together into groups where again the discussion and comparison of the definitions practices the use of the language of the domain. In the case of biology the incorporation of images would also be important.

Using the pattern OBJECTS TO TALK WITH the vocabularies and definitions are made into objects to talk with through being externalized, resulting in the sharing of individual definitions in groups, with peer assessment, commentary on other definitions and voting for the best definitions.

The pattern CLASSROOM DISPLAY can be used as these meanings become more stabilized enabling the sharing of personal understandings of vocabularies with a trusted audience.

The SHOWCASE LEARNING pattern becomes applicable as these definitions are refined, moving up from small groups to tutorial groups and finally to the whole class with a process of voting and selecting the best at each stage, enabling the public celebration of the students' work.

There are some potential pitfalls in this approach:

- No one definition may incorporate all the necessary parts, and a synthesized ideal version may be required
- There is a danger that vocabulary definitions may be undermined by voting systems and perhaps the most amusing definitions rather that the best definitions become the ones remembered.

However, what finally ends up in the public space can be filtered by the tutor, and the tutor can also facilitate some kind of synthesis if this is needed, and it is likely that the putting up of definitions into a public space, in the form of a show case, would encourage the process to be taken very seriously by the students.

Technologically this would be delivered as a forum or a wiki in Moodle.

6.5 Augmented domain map

Below is a map of our cases and patterns, with reference to Black and Wiliam's key aspects of formative assessment.

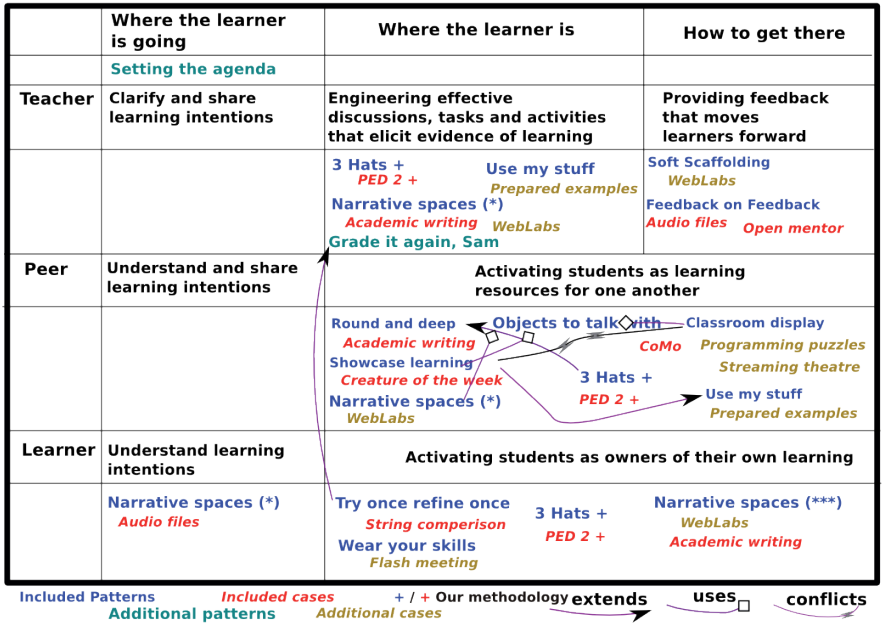


Figure 4: Augmented Domain Map

7 DISCUSSION AND ANALYSIS

7.1 Parameters emerging from the project

On the basis of the literature review, the engagement with practice in the field as well as team meetings throughout the project (n = 18), a set of parameters was developed, which are key in the context of analyzing and planning for formative e-assessment:

- nature of feedback (extrinsic/intrinsic), frequency, role and functions (monitoring, diagnosing, instructionally tractable);
- affordance of moments of contingency;
- potential for learner self-regulation;
- iteration;
- scope for sharing outputs and ideas with peers;
- focus on where the learner is going;
- length of cycle;
- potential for pedagogical modification;
- scope for closing the gap;
- contribution to future learning trajectories;
- measurable attributes.

We offer them here in no particular order as possible focal points for discussion in the design of instructional episodes and/or the development of future e-assessment tools but wish to stress that they are neither systematic nor have they necessarily been empirically tested and verified.

It is in particular the notion of variance implicit in parameters, i.e. the extent to which the strategies of our domain map can and should vary according to context and situation, that seems important to us. In other words, they provide a way of operationalising the domain map. So we might initially and tentatively associate the parameters with the formative assessment strategies in this way:

Strategy: clarifying and sharing learning intentions and criteria for success
Associated parameter: focus on where the learner is going;

Strategy: engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding

Associated parameters: affordance of moments of contingency; poten-

tial for pedagogical modification; scope for closing the gap; contribution to future learning trajectories

Strategy: providing feedback that moves learners forward
Associated parameter: nature of feedback (extrinsic/intrinsic), frequency, role and functions (monitoring, diagnosing, instructionally tractable);

Strategy: activating students as instructional resources for one another
Associated parameter: scope for sharing outputs and ideas with peers;

Strategy: activating students as the owners of their own learning.Associated parameter: potential for learner self-regulation;

The remaining three parameters that we have identified (i.e. iteration, length of cycle, measurable attributes) might be thought of as parameters of the overall teaching and feedback context rather than of a specific strategy. We realise, of course, that further work is needed on these parameters in order to enhance their utility. Sadly, this was not possible within the scope of the current project – the field of formative e-assessment is simply too complex to be covered exhaustively.

A first step in developing the parameters further, we believe, is to clarify definitional basis. For the purposes of this report we provide a brief discussion of the notion of contingency here by way of illustration: contingency has a variety of possible meanings and is used differently across disciplinary divides. In sociological contexts it tends to denote a questioning of a single form of organisation being best in all circumstances. The (formative) assessment literature explains the notion as follows:

> Teachers using assessment for learning continually look for ways in which they can generate evidence about student learning, and they use this evidence to adapt their instruction to better meet their students' learning needs. They share the responsibility for learning with the learners--students know that they are responsible for alerting the teacher when they do not understand. Teachers design their instruction to yield evidence about student achievement, by carefully crafting hinge-point questions, for example. These create 'moments of contingency', in which the direction of the instruction will depend on student responses. Teachers provide feedback that engages students, make time in class for students to work on improvement, and activate students as instructional resources for one another.
>
> (Leahy, Lyon, Thompson and Wiliam, 2005)

A second step would involve a careful mapping of the parameters onto the domain map as well as the Conversational Framework. This process the team has started (see Section 7.2) but it was not possible to develop such a mapping fully within the time constraints of this project.

7.2 Analysis matrix

In this Section, we attempt to apply the parameters introduced above to Laurillard's Conversational Framework. Figure 5 showcases a cross-section of an initial analysis based on the Conversational Framework (section 4, Figure 2). Figure 6 picks up the elaboration in the comments on the Conversational Framework.

This work could be usefully augmented by working further on the analysis frame, applying the analysis frame to a wider range of more highly developed patterns as well as to map the emerging parameters onto the domain map for them to act as an elaboration of the elements in it.

We argue here that working in this way of testing the patterns against the parameters works as a test in both directions because it also challenges whether the elements in the framework are described well. Applying it to more patterns would allow us to critique the representation of the domain map.

Importantly, the test has demonstrated the limitations of certain patterns in terms of the need for them to be further developed. It would certainly have been beneficial, had we been able within the limited scope of the project, to test the analysis matrix out on practitioners and software developer in a further Practical Enquiry Day. Yet, we believe that the tool, combined with the design pattern methodology described in Section 5, has potential for analysing practice, planning instructional interventions and designing tools for e-assessment.

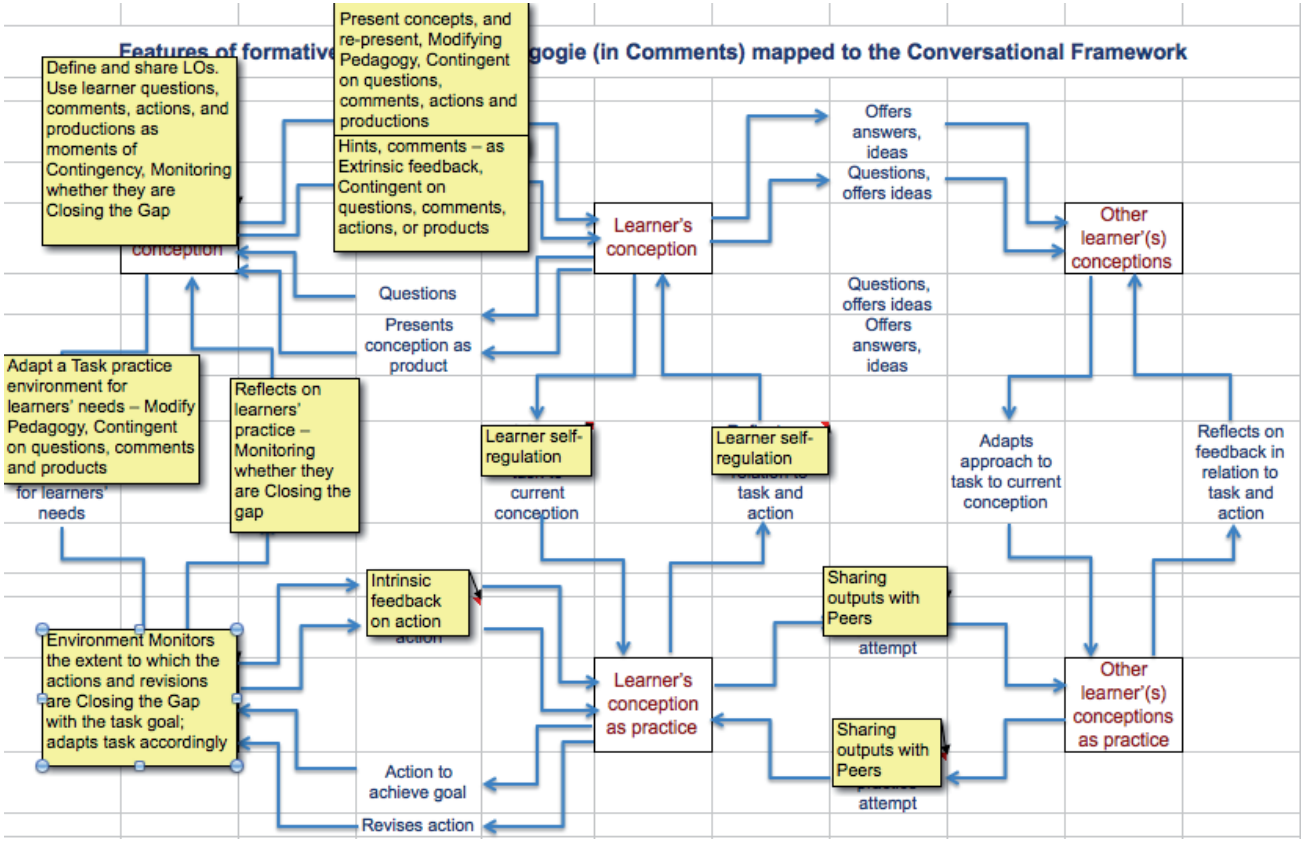


Figure 5: Features of formative assessment pedagogies mapped to the Conversational Framework (with comments)

Design Pattern and Problem	Round and Deep	Soft Scaffolding	Try Once, Refine Once
How does the Pattern motivate learners to:	You want the whole class to benefit from the experiences of individual students in your class	For accelerating learning but in a non-directive way	Lack of immediate feedback leads to fossilisation of errors; immediate feedback can hinder effective learning
access alternative explanations and presentations of the theory, ideas or concepts?	individual activity which exercises the concept from a number of perspectives		
ask questions about their understanding of the theory, etc, by providing the opportunity for answers from the teacher?			
ask questions about their understanding of the theory, etc, by providing the opportunity for answers from their peers?			
offer their own ideas and conceptual understanding, by providing comment on them from the teacher?	Asking students to present findings to you compels them to clarify their own thought		
offer their own ideas and conceptual understanding, by having comment on them from their peers?			
use their theoretical understanding to achieve a clear task goal by adapting their actions in the light of teacher comments?			Feedback on any remaining errors is given, along with the correct answer(s)

Design Pattern and Problem	Round and Deep	Soft Scaffolding	Try Once, Refine Once
use their theoretical understanding to achieve a clear task goal by adapting their actions in the light of peer comments?			
use their theoretical understanding to achieve a clear task goal by adapting their actions in the light of their new understanding?			
use their theoretical understanding to achieve a clear task goal by adapting their actions in the light of intrinsic feedback?			
repeat their practice, by providing intrinsic feedback on actions that enables them to improve performance?			Students are posed questions to elicit answers that can contain multiple errors. A mark is given which contributes to a percentage of the total mark for the question, along with detailed - yet generic- feedback on the location and type of the errors.
repeat their practice, by enabling them to share their trial actions with peers, for comparison and comment?			

Design Pattern and Problem	Round and Deep	Soft Scaffolding	Try Once, Refine Once
reflect on the experience of the goal-action-feedback cycle, by offering repeated practice at achieving the task goal?			
discuss and debate their ideas with other learners?			
reflect on their experience, by having to articulate or produce their ideas, reports, designs, performances, etc. for presentation to their peers?	activity which exercises the concept from a number of perspectives… sharing other students' experiences, misconceptions and breakthroughs		
reflect on their experience, by having to articulate or produce their ideas, reports, designs, performances, etc. for presentation to their teachers?	presentations and discussion to exchange ideas, concerns, lessons learned ... present findings to fellow students.		

Figure 6: Testing the Pattern (learners)

8 RECOMMENDATIONS

On the basis of the project reported on here it is possible to make the following recommendations:

1. To recognise the viability of the design pattern methodology as a tool for developing principled approaches to formative e-assessment across the sector for practitioners as well as software developers. We recommend it to JISC for adoption and further development.

2. Our patterns are not direct recipes for software development, and – due to the limited scope of the project – offer only a sporadic coverage of the domain. We therefore recommend that:

    - JISC fund further research towards a comprehensive language of design patterns for formative e-assessment;

    - JISC fund further research engaging interdisciplinary communities of pedagogics, educators and software developers in iterative participatory pattern-based production of tools for formative e-assessment.

3. Just as developers of web-based computer-mediated interaction systems should consult the relevant collections of patterns (e.g. van Duyne et al, 2007 or Schummer & Lukosch, 2007), so should developers wishing to address formative e-assessment consult pattern collections in this domain. This applies both to developers of new assessment-specific tools, and to those wishing to introduce elements of formative assessment into existing e-learning systems. Our patterns should obviously prove relevant, as would the feedback patterns of Eckstein et al (2002) and the formative assessment patterns of Mislevy at al (2003; 2007, Wei et al, 2008). We must add a caveat: patterns derive their power from being context – and problem-dependent. One of the pitfalls developers need to beware of it that of applying the right pattern to the wrong problem.

4. Since formative assessment is interleaved with the teaching and learning process we would strongly advise against the development of new, unintegrated tools. Instead, we see a much greater value in the adaptation of existing e-learning tools (VLEs / LMSs / etc.) to function in a formative way. One possible way to achieve this goal would be to identify which design patterns of formative e-assessment can be readily applied to existing systems.

5. To set a standard of quality in software design, by requiring software development bids to specify the pattern collections they intend to consult, and to report on the patterns used in their design and production process.

6. Issue guidance and advice to practitioners and software developers stressing the importance of a focus on learners' individual learning trajectories as well as of moments of contingency, how to handle them pedagogically and how to build them into software development.

   The patterns identified in the project provide one source of such detailed advice. These patterns are organised in terms of the domain map in Fi-gure 4, which thus provides a link between the five strategies for formative assessment identified by Black and Wiliam (2009) and the patterns, enabling a selection of appropriate patterns to match specific needs.

   The parameters discussed in Section 7.1 throw additional (if somewhat tentative) light on detailed changes to systems (understood as both human and technological systems working together) that should be explored. Therefore:

   Strategy: clarifying and sharing learning intentions and criteria for success. Most systems do not pay enough attention to determining where the student wishes to go – they take the learning objectives as defined by the teacher – systems need greater flexibility in expressing goals, and enabling the learner to reflect on their goals.

   Strategy: engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding. Systems need to make visible to the teacher what the student is actually doing, and hence enable identification of difficulties. Systems need to be pedagogically modifiable – not just in content, but able to be modified to adopt new approaches. Systems need to have a variety of means to close the gap between the learner's present knowledge and the learning goals. Systems need to be able to relate students' activities to their overall learning goals as well as the teacher's learning goals.

   Strategy: providing feedback that moves learners forward. There is a significant literature on the nature of effective feedback which needs to be explored in order to provide specific guidelines here.

   Strategy: activating students as instructional resources for one another.

Systems need to enable the sharing of outputs amongst students.
Strategy: activating students as the owners of their own learning. Systems need to enable the development of self-assessment and reflection in learning.

7. Offer focused funding in the field of formative e-assessment to

   - provide the opportunity to further develop the theoretical, conceptual and methodological work initiated by this project;

   - support work in aspects of formative assessment this project has not been able to cover (in sufficient depth), e.g. grouping, classroom aggregation technologies;

   - develop the emerging analytical tools into fully blown instruments for the evaluation and augmentation of existing pedagogical practice facilitate the development of tools and applications to support pedagogical innovation in which e-assessment is integral;

   - to ensure maximum benefits realisation, the project team recommends the funding of an online self-evaluation, design-support and staff development tool for formative e-assessment based on the findings of the project.

8. Support the establishment of a network of practitioners and software developers inter alia to

   - enable sustained dialogue and to ensure synergies between these two communities;

   - foster the development of further case studies, patterns and scenarios of use.

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APPENDIX: PLANET PROJECT METHODOLOGY

The project methodology draws heavily on the Participatory Methodology for Practical Design Patterns which originates in the Learning Patterns project (Mor & Winters, 2008; Winters & Mor, 2009; http://lp.noe-kaleidoscope.org/), and has been extensively developed by the Pattern Language Network project (Finlay et al, 2009; http://patternlanguagenetwork.org/). This methodology is described in detail on the Planet website: http://purl.org/planet/Outcomes/Methodology. Our project has combined that methodology with established social science practices in order to embed it in the specific professional context of formative e-assessment in higher education.

The methodology centres on identifying ensembles of context, problem and solution in a domain of practice. These form the core of what we call design patterns; a term coined by Christopher Alexander in the theory of architecture (Alexander et al., 1977), and since then adopted widely in domains such as software engineering, interaction and interface design, and organisational change (cf. Mor and Winters, 2007 for a review).

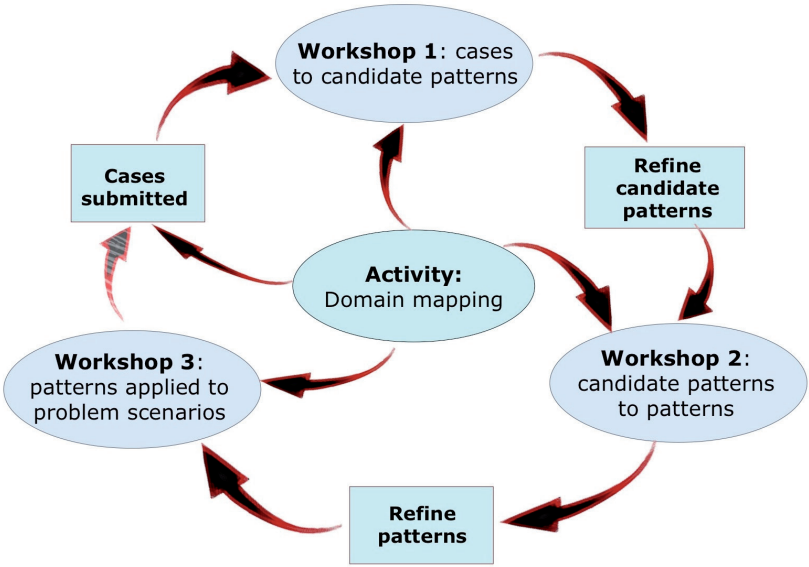


Figure 1:Planet's Participatory Pattern Workshop (PPW) methodology

The methodology has been described by the Planet team in its own terms – as a set of design patterns. We present it here in that form (reproduced with permission from Finaly et al, 2009). This stems from our conviction in the utility of this approach, and its suitability for research-informed practice. It also allows us to present and demonstrate at the same time.

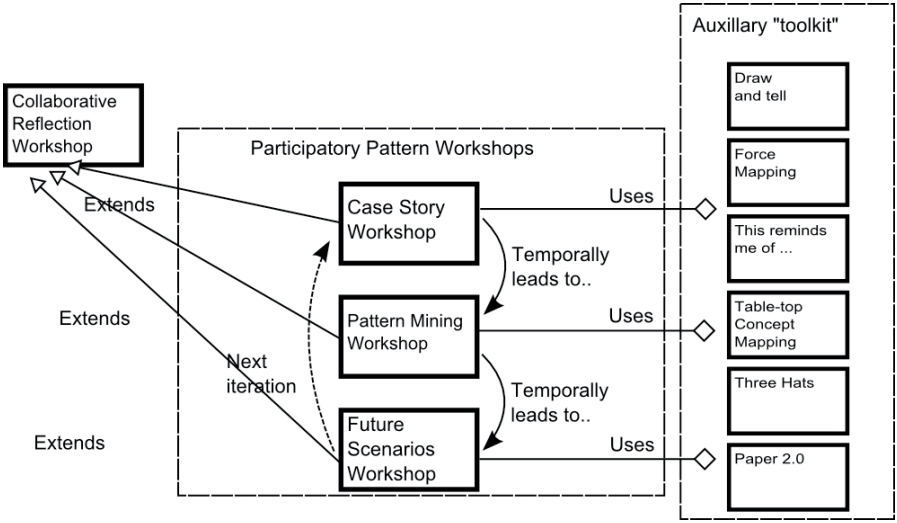


Figure 2: Map of PPW Patterns

Participatory Pattern Workshop	The *Participatory Methodology for Practical Design Patterns* was developed by the Learning Patterns project and refined by the Planet (Pattern Language Network) project. It is a process by which communities of practitioners can collaboratively reflect on the challenges they face and the methods for addressing them. The outcome of the process is a set of case stories, design patterns and future scenarios situated in a particular domain of practice. At the heart of this process are three Collaborative Reflection Workshop.
Collaborative Reflection Workshop	Elicit design knowledge by sharing, analysing and scrutinising personal experiences. This is the base structure, the "super-pattern" for all workshops.
Case Story Workshop	Engender collaborative reflection among practitioners by a structured process of sharing stories, and elicit candidate patterns.

Pattern Mining Workshop	Use comparative analysis of case stories to refine proto-patterns. Elaborate candidate patterns to qualified patterns, by articulating the problem, context, core of the solution and related patterns, and identifying supporting cases.
Future Scenarios Workshop	Put patterns to the test by applying them to novel real problems in real contexts.
Three Hats	I tell a story, you write it down, and she will present it.
Table-Top Concept Mapping	Establish a shared vocabulary by negotiating a concept map of the domain.
Paper 2.0	Paper is a wonderful technology, but web2.0 has some nice features. Why not combine the best of both?

Table 1: Summary of Planet Methodology Patterns

Yishay Mor and Niall Winters (2008) Participatory design in open education: a workshop model for developing a pattern language, Journal of Interactive Media

Niall Winters and Yishay Mor (2009) Dealing with abstraction: Case study generalisation as a method for eliciting design patterns, Computers in Human Behavior, Available online 14 February 2009 .

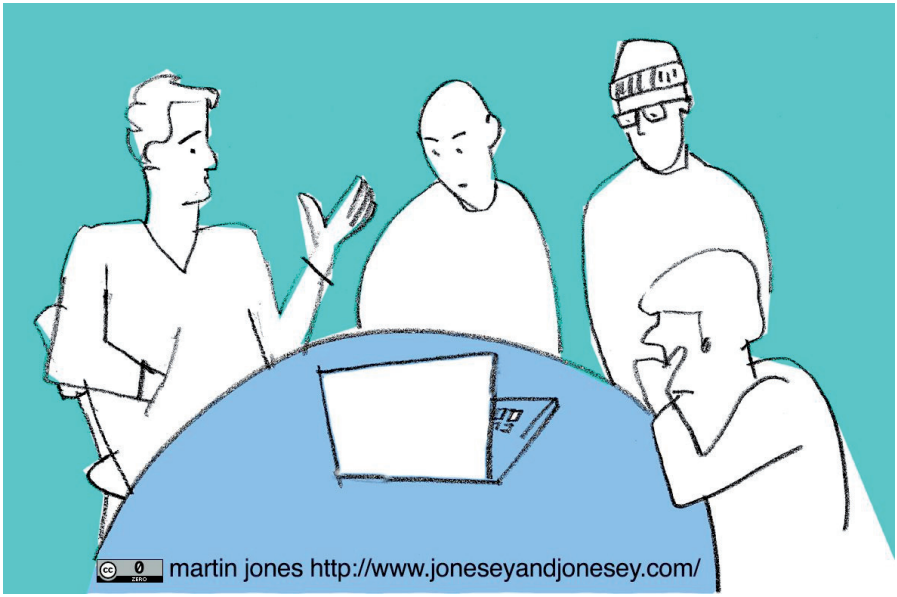
Finlay, J., Gray, J., Falconer, I., Hensman, J., Mor, Y., and Warburton, S. (2009) Planet: Pattern Language Network for Web 2.0 in Learning: Final Report, March 2009. Available from www.patternlanguagenetwork.org/reports

PARTICIPATORY PATTERN WORKSHOP

http://purl.org/planet/Patterns/ParticipatoryPatternWorkshops

The *Participatory Methodology for Practical Design Patterns* is a process by which communities of practitioners can collaboratively reflect on the challenges they face and the methods for addressing them. The outcome of the process is a set of case stories, design patterns and future scenarios situated in a particular domain of practice.

It was developed by the Learning Patterns project and refined as the *Planet Pattern Methodology* by the Planet (Pattern Language Network) project.



Problem

The last decade has witnessed a growing acknowledgement of the design pattern paradigm for research and practice in the learning sciences (e.g., Bergin, 2000; Goodyear et al, 2004; Brouns et al. 2005; Retalis et al, 2006). This paradigm signals a potential to address the challenges of *the design divide* in technology-enhanced learning (Winters and Mor, 2008). Yet despite the apparent promise of this movement, it has so far had limited impact on educational

research and practice. In part, this is due to the unfamiliar discourse that the design paradigm brings to the field education. In part, it might be attributed to two of the fundamental assumptions behind this paradigm, namely timelessness and expertise. In a domain dominated by accelerated change, both of these assumptions are disputed.

Timelessness refers to qualities of artefacts which have been refined over an extensive period of use. Expertise suggests that design knowledge has a focus of locus. Alexander's seminal work (Alexander at al, 1977) was focused on the design of built environment. In this domain, there are certain problems, and associated solutions, which are rooted in fundamental characteristics of human existence, and have been refined over millennia. For example, the form and location of doors and windows. Architects' expertise relies on tacit knowledge of these patterns. The agenda of the design patterns movement included an attempt to democratise the design of buildings, giving residents greater ownership over their living spaces.

We are concerned with advanced digital learning environments. In this domain the rate of change is such that new solutions are afforded and new problems emerge every day. No one person can keep apace of all changes, and so expertise becomes highly distributed: an early adopter of one technology may become an expert in its use, while falling behind on other fronts. The challenge is no more one of pushing design knowledge down from experts to laypeople. Instead, we have a much more complex problem of continuous sharing of design knowledge across networks.

In order to elicit powerful and contemporary design patterns from communities of educational practitioners, and make these patterns useful for broad audiences, we need a structured process of guided design-level conversation, leading participants from their personal experiences to coherent pattern languages.

Context

The methodology is aimed at interdisciplinary communities of practitioners engaged in collaborative reflection on a common theme of their practice. These can be ad-hoc communities, e.g. participants in a workshop, but a sense of community is nonetheless a prerequisite, in the sense of a common commitment to an inquisitive process and a genuine attempt to establish a shared discourse.

The methodology assumes a *blended* setting: at its heart is a series of workshops; co-located (on-site) meetings of 4-8 hours. In between these meetings,

and to an extend within them, participants communicate and develop their ideas using an on-line collaborative authoring system.

Solution

The methodology is based on two fundamental assumptions: *we are all experts, and we are all designers*. This methodology utilises *narrative epistemology*: practitioners are prompted to recount their experiences as case stories, and discuss these with their peers. The construction and discussion of these narratives are scaffolded by a set of tools and activities to extract transferable and verifiable elements of design knowledge in the form of *design patterns*.

This methodology defines a process by which individuals and groups elicit structured design knowledge from their experience through a series of open yet directed activities. In an ideal setting, this process would have the following phases:

- Sharing expertise through structured stories of problems in the target domain and their resolution.
- Scrutinizing and refinement of these stories by guided conversation with peers.
- Comparative analysis with respect to similar cases.
- Extraction of common features across similar cases, in terms of problem, context and method of solution.
- Grouping triplets of context, problem and solution as proto-patterns.
- Articulation of problem description by collaborative mapping of forces.
- Collaborative composition of a map of key concepts emerging from the cases and the analysis.
- Articulation of alpha-state design patterns based on the proto-patterns using the vocabulary derived from the concept mapping.
- Developing these patterns to beta-state, by providing support, in the form of triangulating cases and theoretical rationale.
- Introduction of novel problems, in the form of future scenarios.
- Validating the patterns and demonstrating their use by applying them to the scenarios.

This process is realised by a series of Collaborative Reflection Workshops, typically:

1. A Case Stories Workshop
   Engender collaborative reflection among practitioners by a structured process of sharing stories.

2. A Pattern Mining Workshop
   Eliciting patterns by reflecting on and comparing case stories.
3. A Future Scenarios Workshop
   Addressing validation and dissemination by applying the patterns to novel problems from real situations.

Ideally this would be a series of 3-4 full-day workshops, with 1-2 months in between. However, this process can be condensed as circumstances dictate. Needless to say, expectations should be adjusted to match the allocated resources.

Related Patterns

Uses:

Collaborative Reflection Workshop, Case Stories Workshop, Pattern Mining Workshop and Fututre Scenarios workshop

These are assisted by:

Draw and Tell, Three Hats, This Reminds Me Of… and Table-Top Concept Mapping

COLLABORATIVE REFLECTION WORKSHOP

http://purl.org/planet/Patterns/CollaborativeReflectionWorkshop

Elicit design knowledge by sharing, analysing and scrutinising personal experiences.

Problem

Technology-infused social practices produce complex and dynamic problems. Addressing such problems requires on-going design-level conversation between designers and practitioners involved in diverse aspects of the problem domain. Such a conversation is most effective when it is grounded in actual experiences, concrete problems, relevant to the participants current work, which have been solved or are still pending solution.

In order for such a discussion to be fruitful, it needs to be open, trusting and convivial. At the same time it should be critical, focused and output-directed. These qualities tend to create conflicting forces, in particular in ad-hoc communities, which cannot rely on established norms and relationships.

Context
Multi-disciplinary communities of practitioners interested in exploring a common theme of their practice.

Solution
Identify a theme of interest within the domain of practice. This theme should be focused enough to draw people who can benefit from each others' experiences, and wide enough to support rich examples and dilemmas. Convene a workshop where participants work in groups to explore the selected theme through sharing personal experience.

Workshop participants should ideally be recruited sufficiently in advance to allow them to engage in preparatory work and to begin to engage through their chosen medium of communication (e.g. a mailing list). A collaborative workspace (such as a wiki) may provide a richer environment for distributed work.
The workshop itself should offer clearly defined activities, based around small group work. These can include inspirational exposition activities, such as Draw And Tell, which aim

- to establish an open, honest and fearless tone of conversation;
- to provoke participants to abandon entrenched forms of discourse;
- to provide a fresh and humorist perspective on the theme of the day.

Each group selects a contribution of one of its members, elaborates and scrutinises it in a structured discussion, e.g. by means of a Three Hats discussion. Provide the groups with scaffolding to guide the discussion. A This Reminds Me Of... exercise can be used to elicit comparable experiences, either from the existing repository or from participants' memory. A Table-Top Concept Mapping exercise can be used to elicit key concepts and focal issues from the contributions tabled by the group.

Groups should be encouraged to share their outputs with the wider group to enable broader feedback.

Following the workshop participants should be encouraged to share new contributions and comment on those of others.

Before the workshop
- Enlist the participants well in advance, ideally 3-4 weeks before the event.
- Establish a reliable medium of communication with all participants (e.g. a mailing list)

- Provide a tool for collaborative authoring of multi-media texts, and mark a clear space for the workshop within that space.
- Introduce the workshop in terms of aims, rationale and methods.
- Ask all participants to make a contribution:
  - Contributions should follow a common theme, or answer a common question.
  - They should also adhere to a common structure, realised by a template.
  - Provide an example of the desired output.
- Follow-up by -
  - Encouraging those who have not submitted a contribution to do so.
  - Commenting on the submitted contributions, and asking authors to iterate on them.
  - Pointing out links between contributions and provoking authors to comment on each other work.

On the day

Briefly present the theme, methods and objectives of the day. Introduce the first activity, and split the participants into groups.

Working in groups of 3-6, participants:

- Begin with an inspirational exposition activity, e.g. a Draw and Tell game. The aims of this activity are:
  - To establish an open, honest and fearless tone of conversation.
  - To provoke participants to abandon entrenched forms of discourse.
  - To provide a fresh and humoristic perspective on the theme of the day.
- Each group selects a contribution of one of its members, elaborates and scrutinises it in a structured discussion, e.g. by means of a Three Hats discussion. Provide the groups with a list of questions to guide the discussion.
- Use a This Reminds Me Of exercise to elicit comparable experiences, either from the existing repository or from participants memory.
- Use a Table-Top Concept Mapping exercise to elicit key concepts and focal issues from the contributions tabled by the group (*optional*).
- Instruct the groups to produce a concrete artefact, which can be shared with other groups and with a broader audience.

Converge to a plenary, in which each group presents its work.

Conclude with a feedback and reflection discussion, in which participants recap their experience from the day.

After the workshop

Prompt participants to

- Publish any new contributions that emerged on the day.
- Add details and artefacts (images, illustrations, diagrams, links, etc.) to their contributions.
- Comment on the contributions, noting questions that have emerged from the discussion.

Related Patterns

Extended by

Case Study Workshop, Patern Mining Workshop and Future Scenarios Workshop

Uses:

Draw And Tell, This Reminds Me Of, Three Hats and Table-Top Concept Mapping

Used by:

Participatory Pattern Workshops

CASE STORY WORKSHOP

http://purl.org/planet/Patterns/casestoryworkshop

Engender collaborative reflection among practitioners by a structured process of sharing stories.

www.maisieplatts.com

Problem
Schank and Abelson (1977) argue that stories about one's experiences, and the experiences of others, are the fundamental constituents of human memory, knowledge, and social communication. They call for a shift towards a functional view of knowledge, as Schank (1995) explains: "intelligence is really about understanding what has happened well enough to be able to predict when it may happen again" (p. 1). Such knowledge is constructed by indexing narratives of self and others' experiences, and mapping them to structures already in memory. Bruner (1986; 1990; 1991; 1996) identified narrative as the predominant vernacular form of representing and communicating meaning. Humans use narrative as a means of organizing their experiences and making sense of them. A narrative is always contextualized. It habitually begins with an exposition, which lays out the context: time, location, props and characters. These ideas are supported by recent findings in neuropsychology and cognitive psychology (Mar, 2004; Atance and O'Neill, 2005; Atance and Meltzoff, 2005).

While everyone enjoys a good story, not everyone trusts their ability to tell a good story. People who base their confidence on a professional image often hesitate to share personal stories in public.

When people are induced to share stories, they tend to harness them to three interleaved goals: understanding the world in which they operate, establishing their identity, and identifying methods of problem solving ("where am I, who am I, how do I get where I want?"). In order to establish a productive design-level conversation, we need to subdue the first two and amplify the latter.

Context
Communities engaged in collaborative reflection on their practice, using design patterns as part of their discourse.

This pattern assumes a co-located (on-site) half to full day workshop with 20-30 participants, and with a collaborative authoring system to support a-synchronous contributions before, during and after the workshop.

It can be adapted to smaller or larger groups, and to a shorter time-frame. A cohesive community could also adapt it to a distributed location event using audio-graphic conferencing.

Solution
Establish a case-driven discussion of common problems and solutions in the target domain, by facilitating a Collaborative Reflection Workshop, focused on par-

ticipants' stories of their own experiences. The discussion is instigated by prompting participants to post their case stories in a shared space. It culminates at a workshop, where the scenarios are analysed by groups of 3-6 participants. After the workshop, participants and facilitators revisit the cases, patterns and scenarios that were discussed.

Apply the COLLABORATIVE REFLECTION WORKSHOP structure, adding:

Before the Workshop
Instruct participants to contribute a story from their own experience, using a S.T.A.R.R template:

Situation
- What was the setting in which this case study occurred?

Task
- What was the problem to be solved, or the intended effect?

Actions
- What was done to fulfil the task?

Results
- What happened? Was is a success? What contributed to the outcomes?

Reflections
- What did you learn from the experience?

Here is an example of the template as a powerpoint presentation: http://www.slideshare.net/yish/star-case-study-template Provide guidelines for "good stories" Example: http://www.slideshare.net/yish/case-study-how-to-presentation

On the day
Provide guiding questions for the THREE HATS and THIS REMINDS ME OF… discussions, such as:

- What is the story about?
- What is it an example of?
- What was successful, what was not so successful?
- What was the critical element of design behind success?
- What was the critical contextual factor?
- When would it fail?

Related Patterns
Extends:
COLLABORATIVE REFLECTION WORKSHOP

Used by:
Participatory Pattern Workshops

Leads to:
Pattern Mining Workshop and Future Scenarios Workshop

PATTERN MINING WORKSHOP

http://purl.org/planet/Patterns/patternminingworkshop

Use comparative analysis of case stories to refine candidate patterns. Elaborate the candidate patterns to full patterns, by articulating the problem, context, core of the solution and related patterns.

Problem

Case Story Workshops guide practitioners in articulating problem-solving narratives from their experience. Narratives are a fundamental form of capturing and communicating knowledge. Yet they fall short in several accounts:

- The endpoint of a narrative, its central message, is always implied. In order to expose it to scrutiny it needs to be made explicit.
- Narratives are loosely structured, and thus do not lend themselves to modularisation.
- Practitioners reporting on their experience often take critical factors for granted, both in terms of the context and in terms of the key actions they took.

Design patterns provide a semi-structured form, which exposes the gaps and hidden messages in the case stories, while eliminating superfluous detail. However, the transition from case stories to patterns might seem insurmountable for the uninitiated. Many pattern communities rely on "pattern scouts", experienced pattern authors who mine practitioners' stories for potential patterns. While this approach may guarantee quality, it does not scale, and it loses the intimate knowledge of a first person account.

Context
Communities engaged in collaborative reflection on their practice, using design patterns as part of their discourse.

This pattern assumes a co-located (on-site) half to full day workshop with 20-30 participants, and with a collaborative authoring system to support a-synchronous contributions before, during and after the workshop.

It can be adapted to smaller or larger groups, and to a shorter time-frame. A cohesive community could also adapt it to a distributed location event using audio-graphic conferencing.

Ideally workshop participants should have conducted a CASE STORY WORKSHOP prior to the event, but alternatively the two workshops can be combined to one.

Solution
Facilitating a COLLABORATIVE REFLECTION WORKSHOP which shifts the conversation from a case-driven discussion to a pattern-based discussion of common problems and solutions in the target domain. Present groups with case stories from a previous CASE STORY WORKSHOP and prompt them to compare the cases and identify recurring patterns. Guide them in articulating these patterns in full.

Apply the COLLABORATIVE REFLECTION WORKSHOP structure, adding:

Before the workshop
- Collate a selection of case stories pertinent to the workshop theme, including both previous contributions of the workshop participants and notable contributions from other sources.
- Prompt participants to comment on these cases and identify possible links.

On the day
Introduce the selected cases using an exercise which provokes attentive reading, e.g. use them as inputs for a TABLE-TOP CONCEPT MAPPING exercise.

Instruct participants to

- identify parallels between the cases in terms of context, problem and solution. These should be noted succinctly on cards or small note paper.
- choose one of these notes, and elaborate it as a full-bodied pattern.

First, ask the groups to present a short portrayal of the new pattern, by providing -

- Name
- Short description
- Illustration

Next, guide them in using a pattern template, e.g:

Name

- Naming is important. Think of a short catchy phrase that captures the essence of your pattern. Pattern names are often imperative - 'do this'.

Summary

- Try to capture the essence of the pattern in 2-3 sentences. Focus on function - what it does, not how its built. The summary will appear as a tooltip on the index page.

Illustration

- Metaphoric or inspirational image or graphic, which captures the spirit of this pattern.

Problem

- What is the problem that this pattern addresses? What does it try to achieve? One useful method of defining the problem is as a conflict between the two main forces dominating the situation.

Context

- When and where is this pattern most relevant? To which settings can it be extended?

Solution

- Describe the core of the solution in such a way that it can be directly implemented a million times without doing the same thing twice.

Diagram

- Structural or narrative graphic which supports the detailed description of the solution.

Related Patterns

- list other patterns related to this one, under categories such as component, assisting, conflicting, uses this, etc.

Support

Source

- The original case story from which this pattern was derived.

Triangulation
- Additional supporting cases where this pattern was observed

Rationale
- Theoretical justification.

Verification
- Scenarios / solutions which were developed using this pattern.

Provide specific guidance on articulating each one of the core components. For example: http://www.slideshare.net/yish/stories2patterns-presentation

Related Patterns

Extends:

Collaborative Reflection Workshop

Follows:

Case Story Workshop

Leads to:

Future Scenarios Workshop

FUTURE SCENARIOS WORKSHOP

http://purl.org/planet/Patterns/FutureScenariosWorkshop

Put patterns to the test by applying them to novel real problems in real contexts.

Problem
Design patterns provide a powerful language for such a conversation, enabling stake-holders to identify potential problems as early as possible and make an informed choice of solutions. Paradoxically, often as more expert knowledge is embedded in a pattern language it becomes less accessible to novices. In order for patterns to be used effectively by their prospective audience, they need to be presented in an approachable manner.

Furthermore, many patterns suffer from lack of validation; while they may seem compelling, this impression is not backed by unbiased empirical evidence. This reduces the audiences' confidence in patterns, and creates a second obstacle to their adoption.

Such problems can be overcome by meticulous efforts on behalf of the pattern authors. Yet, with the abundance of candidate patterns, which can emerge from any design discussion, for example at a PATTERN MINING WORKSHOP, we need a mechanism for prioritising efforts.

Context
Communities engaged in collaborative reflection on their practice, using design patterns as part of their discourse.

This pattern assumes a co-located (on-site) half to full day workshop with 20-30 participants, and with a collaborative authoring system to support a-synchronous contributions before, during and after the workshop.

It can be adapted to smaller or larger groups, and to a shorter time-frame. A cohesive community could also adapt it to a distributed location event using audio-graphic conferencing.

Solution
Establish a scenario-driven discussion of case stories and design patterns in a domain of practice, by facilitating a COLLABORATIVE REFLECTION WORKSHOP in which participants share concrete problems in the form of future scenarios, compare them to past cases, and identify the patterns most applicable to form a solution.

The discussion is instigated by prompting participants to post their scenarios in a shared space. It culminates at a workshop, where the scenarios are analysed by small groups of participants. After the workshop, participants and facilitators revisit the cases, patterns and scenarios which where discussed.

Follow the Collaborative Reflection Workshop structure, adding:

Before the Workshop
Instruct participants to contribute a rich description of a real problem they are confronted with in their practice, using a template, which prompts them to specify:

Situation
- What is the setting for this scenario? Describe the educational, technological and institutional setup.

Task
- What is the problem to be solved, or the intended effect?

On the day
Tag the scenario and the cases with keywords and concepts highlighting the essence of the context and the problem.

Find patterns that match the same tags, and consider their utility in solving the problem.

Describe a possible solution, based on applying the selected patterns.

Note how the patterns were modulated to support the solution.

The template should provide additional slots for capturing these outputs, thus producing a coherent description of the problem and its proposed resolution:

Patterns
- Identify patterns appropriate for the situation and the task. How would they inform the solution?

Solution
- Describe a possible solution derived from the patterns you selected.

Expected Results
- Concrete, measurable criteria for success.

Lessons Learned
- What have you learnt from writing this scenario?

After the workshop
Prompt participants to

- Publish any new case stories, patterns and scenarios that emerged on the day.
- Add details and artefacts (images, illustrations, diagrams, links, etc.) to their scenarios.
- Comment on the patterns, noting questions which have emerged from the discussion.

Extends:
Collaborative Reflection Workshop

Used by:
Participatory Pattern Workshops

Uses:
Draw And Tell, This Reminds Me Of, Three Hats and Table-Top Concept Mapping

Follows:
Case Story Workshop, Patern Mining Workshop

THREE HATS

http://purl.org/planet/Patterns/ThreeHats

I tell a story, you write it down, and she will present it.

Problem

Stories (narratives) are a powerful form of capturing, structuring and sharing knowledge. Inexperienced story writers may find it hard to express their knowledge lucidly is this form i.e. storytelling as a craft with flow and form:

- They may feel too insecure or inconfident to simply tell a story, and may drift into terse descriptive phrases, preaching or promotional mode.
- Often they take their setting for granted, and fail to provide a description which would allow readers to contextualise the story adequately.
- Might gloss over inconvenient details.

- Feel constrained by their audience.

Many of these issues can be addressed by offering constructive peer feedback. However, peers may be:

- Reluctant to criticise
- Attribute misunderstanding to their own faults
- Skim the story rather than consider it attentively

Context
Co-located collaborative knowledge sharing activities. i.e.

- Learners are present in the same place and time
- Learning is driven by sharing learners' personal experiences / observations.

In addition, learning is supported by a shared web-based authoring tool. Although this pattern can generalised to relax this requirement, there is added value in this particular setting.

Solution
Instruct learners to work in groups of 3-5. In each group,

- One learner tells a story
- A second writes it using the collaborative authoring tool
- A third will later use this write-up for presenting the story to the larger group.

The collaborative authoring tool needs to provide a Narrative Space.

Preferably, the tool should include a template to provide Soft Scaffolding.

A story is complete when all participants feel that the presenter has enough in the write-up to be able to present the story accurately.

Once the group is satisfied with the outcome they change roles and repeat.

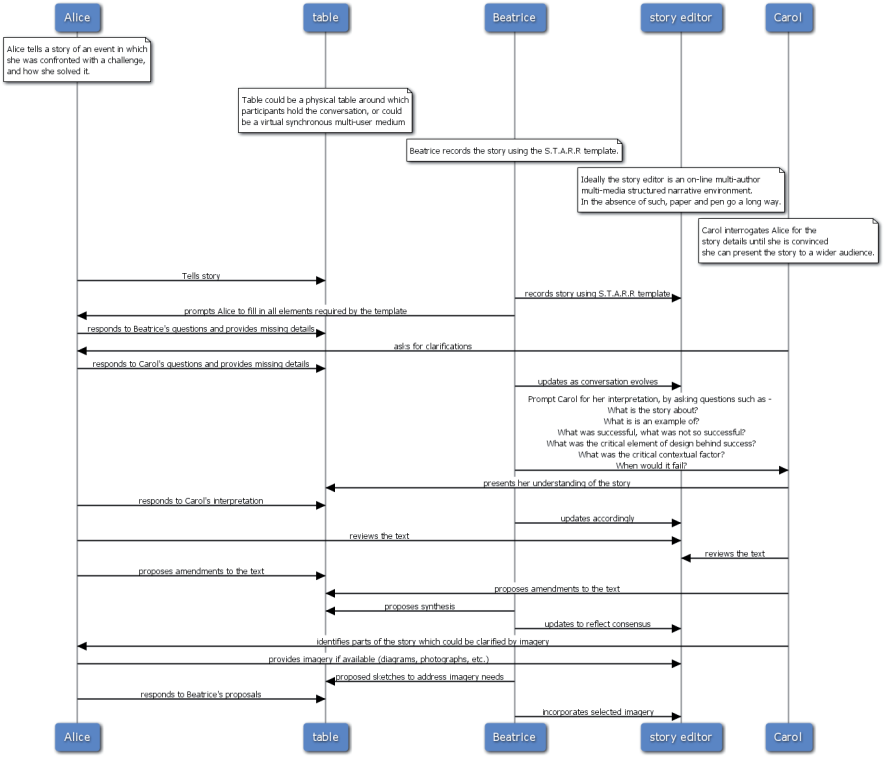

Alice
table
Beatrice
story editor
Carol
Alice tells a story of an event in which she was confronted with a challenge, and how she solved it.
Table could be a physical table around which participants hold the conversation, or could be a virtual synchronous multi-user medium
Beatrice records the story using the S.T.A.R.R template.
Ideally the story editor is an on-line multi-author multi-media structured narrative environment. In the absence of such, paper and pen go a long way.
Carol interrogates Alice for the story details until she is convinced she can present the story to a wider audience.
Tells story
records story using S.T.A.R.R template
prompts Alice to fill in all elements required by the template
responds to Beatrice's questions and provides missing details
asks for clarifications
responds to Carol's questions and provides missing details
updates as conversation evolves
Prompt Carol for her interpretation, by asking questions such as -
What is the story about?
What is is an example of?
What was successful, what was not so successful?
What was the critical element of design behind success?
What was the critical contextual factor?
When would it fail?
presents her understanding of the story
responds to Carol's interpretation
updates accordingly
reviews the text
reviews the text
proposes amendments to the text
proposes amendments to the text
proposes synthesis
updates to reflect consensus
identifies parts of the story which could be clarified by imagery
provides imagery if available (diagrams, photographs, etc.)
proposed sketches to address imagery needs
responds to Beatrice's proposals
incorporates selected imagery
Alice
table
Beatrice
story editor
Carol

TABLE-TOP CONCEPT MAPPING

http://purl.org/planet/Patterns/tabletopconceptmapping

Establish a shared vocabulary by negotiating a concept map of the domain.

www.maisieplatts.com

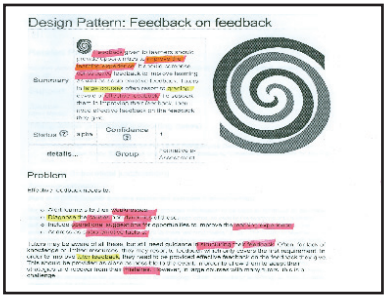
Problem

The Planet methodology aims to engage multidisciplinary communities in a design-level discourse. In order to do that, such a community needs to first establish a shared vocabulary. This vocabulary should be rooted in the practices of the domain, and informed by the relevant bodies of theory.

Context

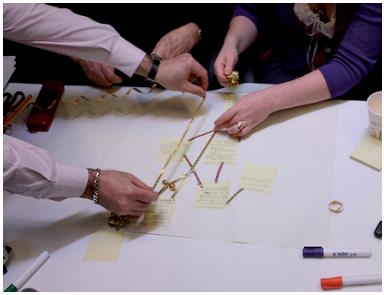
This pattern originates from our Participatory Pattern Workshops, but would probably be relevant in other situations where a group of practitioners are engaged in an on-site (co-located) collaborative reflection.

The basic form of this pattern does not involve any "high" technology: it uses tables, post-it notes, ribbons and markers. However, it would ideally lead to an online, collaborative concept mapping activity. e.g. transfering the map to a tool such as - http://www.aypwip.org/webnote/ or an embedded FreeMind map.



Participants work in groups of 3-5. First, provide each participant a few texts from their previous work, and ask them to highlight key terms using two colours, one for "assets", the other for "hazards". Assets are terms which they see as having a well-understood and agreed meaning, hazards are vague, contentious or provocative terms.

Next, participants need to agree on a common list of "assets" and "hazards", by writing them on two colours of post-it notes. Each post-it should have the term written on top and a definition below.



Having agreed on the list of concepts, the group moves on to mapping them, using coloured threads or markers to note links.

Finally, the group presents its map to other groups for discussion.

In order to build on the outputs of this activity, they need to be converted to a

persistent and manipulable form. This could be done by using the map as a basis for an digital on-line knowledge structure. A less work-intensive alternative would be to apply the PAPER2.0 pattern: post pictures of the map in a shared, annotatable digital space.

Related Patterns

PAPER2.0 and PARTICIPATORY PATTERN WORKSHOP

Paper 2.0

http://purl.org/planet//Patterns/Paper20

Paper is a wonderful technology, but web2.0 has some nice features. Why not combine the best of both?

Problem

Paper is the ultimate mobile technology. It works in broad daylight or near darkness, never runs out of battery, is compatible with all readers, you can survive a 10 meter drop unscratched.

That said, on-line tools have their merits, some of which are hard to implement in paper:

- collaborative commenting and authoring.
- instant zero cost updates
- embedded interactive media

Context
Predominantly informal learning communities, sharing a common interest but geographically disparate.

Solution
Conduct the main expressive activity using a paper based medium, but use a participatory web medium to share, annotate and remix works.

- In small co-located groups explore a theme through drawing, sketching, collage or other forms of paper work.
- Display these works locally at a site relevant to the group (e.g. a classroom display)
- Photograph or scan the works, upload them to a shared area on a photo sharing site, embed these in a wiki or blog dedicated to the activity theme.
- Using the photo-sharing site and the blog / wiki, share the works with similar-minded groups in other locations.
- Annotate / comment on others' work using the participatory web media.
- Print other groups' works to share with your group
- Remix works from remote sites - create collages or paint over them, and upload back to the web.

Related Patterns
Draw and Tell and Objects to Talk With

WLE Centre Website: www.wlecentre.ac.uk

Project Blog: http://feasst.wordpress.com

Wiki: http:// projects.lkl.ac.uk/feasst-workspace