URL: http://www2.tisip.no/E-LEN/

The production of e-learning design patterns, and a research road map for e-learning

Report of Work package 3

E-LEN project: a network of e-learning centres

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Contact autorrs:

Ellen Rusman, OTEC, Open University of the Netherlands
Gaby Lutgens, Learning Lab, Maastricht University
Frans Ronteltap, Learning Lab, Maastricht University

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Introduction

The E-LEN project

E-LEN is a European network of institutions with considerable e-learning expertise and experience. The network is established in order to share and develop information and design patterns regarding e-learning design issues in a systematic manner. An important activity of the network is the dissemination of design patterns to relevant parties. The partner institutions in E-LEN are: University of Cyprus (co-ordinator); The Learning Lab, University of Maastricht (NL); CSALT, University of Lancaster (UK); Ilmenau Technical University (DE); Hypermedia Open Center – Politechnico di Milano (IT); InterMedia, University of Bergen (NO); NITOL (NO); TISIP (NO); National Technical University of Athens (GR); and Open University of the Netherlands (NL).

As in other pattern languages proposed, the patterns produced within the E-LEN project are not necessary new and innovative, they have been incorporated in ICT and learning practices for years. Instead the intention of this form of pattern languages is merely to capture design expertise and present it in a comprehensible and usable format (Lyardet *et al* 99). In this way, designers of new or existing ICT and learning, especially inexperienced designers can take advantage of previous design expertise and save precious time and resources. The specific sub-goal of the E-Len project, related to the production of patterns is:
'to identify and gather best practices, make a collection of design patterns, research roadmaps on e-learning and to enhance the dissemination of such results'.

In this report the support of the working process to come to and the results of this sub-goal are described: it describes the results of collaboration among E-Len partners as a test bed for the development of design patterns for e-learning, as well as the development of a related research road map for prospective activities in the design of e-learning.

Design patterns and pattern languages

Design patterns

Design patterns in e-learning are descriptions of good practice in e-learning. The idea of using design patterns in innovation and improvement of teaching and learning quality has its origin in the domain of architecture. Displeased at the quality of the physical environment in which people live and work, the architect Alexander tried to set a new trend by altering design activities. *Conceptual analysis*, in such a way that *communication* among key agents of the design process as well in implementation is facilitated, are two constituent components of Alexanders' approach. 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.

From design patterns to a pattern language

Through the years many initiatives have evolved around the phenomenon 'patterns'. People from different disciplines used it for different aims and reasons. Some used them to clarify and communicate design experience and to re-use and transfer this experience in new 'design settings', others to bridge the gap between 'theory' (research) and 'practice' (implementation) and again others to introduce novices into a certain knowledge domain. Other aims might be the clarification and ordering of your own design

experience and concepts and to express them in an action-oriented format. Several conceptually related patterns can together form a pattern language, which can help to solve a group of interrelated problems.

Relevance and use

We believe that such a pattern language can have the following advantages for designers (Baggetun & Retalis, 2003):

- Reduced time and cost of design and development,
- Increased software qualities of, especially in the usability sector,
- Increased pedagogical quality, especially learning effectiveness

In the domain of software development Prechelt, Unger, Tichy and Brössler (2001) indeed found empirical evidence that the use of design patterns for the communication and simplified re-use of proven solutions to recurring design problems by the execution of software maintenance was beneficial. The E-LEN project developed patterns which would have the same functionality, but a more integrated approach: converging knowledge of educational and software designers.

The design pattern approach is used and interpreted in different communities and in different ways. Software engineers typically make use of patterns to help them to organise the design space for the convenience of designers. *End users* of software are generally unaware of the specific techniques used in the software production. In contrast, Alexander's intention was to help people understand how their own homes, neighbourhoods and towns might be improved, in large part through their own action. Transferring his intentions to the use of ICT in education, one naturally thinks about how to empower the end users – how to help learners and teachers construct convivial learning environments.

To give an impression of the scope of these initiatives and to position the activities of the E-LEN project in the pattern field, several of the most relevant initiatives in which the ideas of patterns were applied are named and described in the table below. We start with the 'founding father' of Christopher Alexander.

Name initiative	Discipline	Aims
Alexander's patterns for 'living environments'	Architecture	A Pattern Language was originally expected to enable every citizen to design and construct their own home. While that ambitious objective was not entirely realized, it did result in a liberation from empty architectural dogma. Armed with this book, a client can evolve and express his or her own desires for a building. An architect is no longer the absolute and sole source of design ideas and solutions (Alexander, 1977, 1979).
Hillside patterns	Informatics and system design	Patterns and Pattern Languages are ways to describe best practices, good designs, and capture experience in a way that it is possible for others to reuse this experience. Fundamental to any science or engineering discipline is a common vocabulary for expressing its concepts, and a language for relating them together. The goal of patterns within the software community is to create a body of literature to help software developers resolve recurring problems encountered throughout all of software development. Patterns help create a shared language for communicating insight and experience about these problems and their solutions. Formally codifying these solutions and their relationships lets us successfully capture the body of knowledge which defines our

		understanding of good architectures that meet the needs of their users. Forming a common pattern language for conveying the structures and mechanisms of our architectures allows us to intelligibly reason about them. The primary focus is not so much on technology as it is on creating a culture to document and support sound engineering architecture and design (Hillside.net, 2003).
Pedagogical patterns	Education	Pedagogical patterns try to capture expert knowledge of the practice of teaching and learning. The intent is to capture the essence of the practice in a compact form that can be easily communicated to those who need the knowledge (Pedagogical pattern project site, 2003).
Groupware patterns	Informatics and system design (HCI)	A pattern language for groupware facilitates communication within the development team, between the development team and end users, and between end users. It assists practitioners in becoming familiar with the research area of groupware (Schümer, 2003).
Pointer project	Informatics and system design	The project is concerned with investigating the appropriateness of patterns as a means of communicating information about how people interact with each other through and around technology. Ultimately, this is with a view to informing the design process for computer systems to support the work and activities that the people are engaged in (Pointer project).

Each initiative used another format for the description of patterns in the design domain. In the table below an overview of the used formats is given. One can see that in each initiative the idea of a pattern format and it's main structure is interpreted differently, but it's functionality is basically the same.

Alexander's format:

- A picture showing an archetypal example of the pattern.
- An introductory paragraph setting the context for the pattern (explaining how it helps to complete some larger patterns).
- '***' to mark the beginning of the problem.
- A **headline** in bold type to give the essence of the problem in one or two sentences.
- The body of the problem – its empirical background, evidence for its validity, examples of different ways the pattern can be manifested.
- The **solution** in bold type. This is the heart of the pattern – the field of physical and social relationships that are required to solve the stated problem in the stated context. It is always stated as an instruction, so that you know what to do to build the pattern.
- A diagrammatic representation of the solution.
- '***' to show the main body of the pattern is finished.
- A paragraph tying the pattern to the smaller patterns that are needed to complete and embellish it.

Structure derived from example pattern at Hillsite.net:

- Name
- Problem
- Context
- Forces
- Solution
- Resulting Context

- Rationale

Structure derived from example pattern at Pedagogical patterns (Bergin):

- Name
- Thumbnail
- Audience/context
- Forces
- Solution
- Discussion/consequences/implementation
- Special resources
- Related patterns
- Example instances
- Contraindications
- References

Structure at patterns 4 groupware:

- Name
- Author(s)
- Intent
- Family
- Problem
- Scenario
- Context
- Indications
- Solution
- Participants
- Rationale
- Safety rules
- Known uses
- Related patterns
- References
- Cite as

Pointer project

- Name
- Essence of the pattern
- Design for dependability:
    - Why useful?
    - Where used? (examples with vignettes)
    - Design implications

The structure of a design pattern captures the description of an e-learning problem that is analyzed, and presents the solution of that problem. Next to this it contains references for the reader who wants more information with attention to technical, pedagogical and organizational issues and combinations of these categories. However, some problems that are described are not yet solved and lead to research questions. The description of this e-learning problem is called a *research pattern*.

Although the templates of the different initiatives are quite different, some elements are common between the templates. In most cases the following elements are shared:

- a description of a **problem**
- the **context**
- **forces** that play a role in coming to a solution
- the **solution**

So these elements should be minimally be included in the E-LEN pattern structure. Within the E-LEN project we've chosen to develop a template which would be workable and comprehensible within the group and integrated the ideas and structures of a 'research pattern' and 'a design pattern', so that the still open questions would be visible within the pattern. The element 'Research questions' within a pattern would prevent overlap among patterns and make the conceptual relations clearer. Also it would be a basis for the development of a research roadmap. In the E-LEN project the following patterns structure was used:

Name:

Give a name that:

- covers the content (problem and solution)
- is meaningful and easy to remember
- gives rise to associations that are related to the described problem and solution.

Category:

Choose from: pedagogical/organizational/technical. Combinations are possible.

Abstract:

A short paragraph outlining key elements in the pattern.

Problem:

A detailed description of the problem.

Analysis:

An explanation of what makes this problem a problem, and why a solution is needed.

Known solutions:

This section should set out what constitutes a 'good practice' solution to the problem. It can be based on existing practice, or drawn from theory.

Research questions:

A description of any research questions that are still to be solved, and ideas about possible research settings and methods. Other remarks.

Context:

A description of the type of context the solution is applicable to.

Conditions:

A general description of critical success indicators/factors that influence use/implementation of the solution (e.g. required roles, type of resources), resources needed to solve the problem.

Discussion/consequences:

The consequences of use, implementation issues and other remarks.

References:

References for the pattern.

Related patterns:

Related design patterns and research patterns

Author(s):

Date:

Date of completion of the pattern.

Acknowledgements:

Acknowledge any other people or sources of help, information etc.

Organisation of work

Introduction

The e-learning field is growing from childhood to adolescence. Educational professionals obtain more and more experience with the design and implementation of networked-based learning environments. Unfortunately, this experience is not structurally collected yet and represented in handy overviews, so other professionals can profit of them in new design contexts. This is exactly one of the aims of the E-LEN project: it aims to develop and disseminate design knowledge tailored to the needs of people who are professionally involved in e-learning, such as the staff of e-learning centres. This design knowledge is made explicit through design patterns. But the production of patterns has to be organised and supported. In workpackage 3 the support of the development of E-LEN patterns was arranged. How this was done is described in this chapter.

Description of working process

The four SIGs
Several special interest groups were surrected. The special interest groups (SIGs) existed of members of the E-LEN project and people with specific expertise, who were invited by one of the members to participate in the discussion.
From the perspective that facilitation of learning by use of information and communication technology is a key issue, the groups concentrated on four issues.

The issues for discussion in the SIGs were:
1. learning resources and learning management systems
2. lifelong learning
3. collaborative learning
4. adaptive learning

The SIGs were managed by a moderator who had the role of initiator or moderator of the discussion. This moderator submitted a position paper (see attachment A for the position papers), that was used as the start of a brainstorm discussion in which the group explored the domain and relevant problems in relation to e-learning .

Participants chosed to enter one or more SIG's in which they were interested and/or have some expertise in the specific field. They were all asked to log-in regularly, participate actively, to provide feedback to other participants, and to keep an eye on the planning of the project.

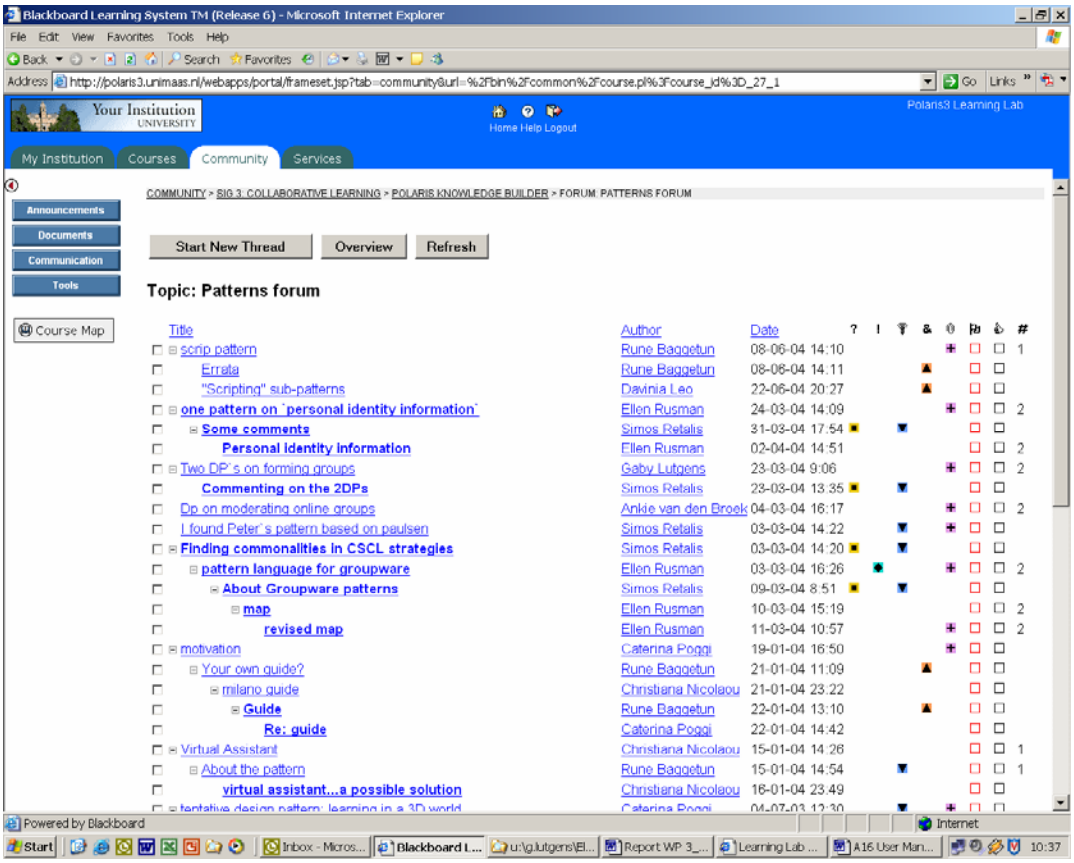
Communication tool and working environment

A general communication tool for asynchronous knowledge building and knowledge management was provided to all SIG-participants[1].
The screen below, taken from SIG 3, shows some characteristics of the communication and knowledge building tool. While the participants are interacting on the topics within the SIGS, they construct a collective knowledge base by adding new information, explaining something to someone, reacting on

[1] The application that is used in the production of the patterns is POLARIS, a tool for knowledge development and knowledge management developed by the Learning Lab, Universiteit Maastricht. POLARIS is a building block in Blackboard (CMS). More information on the tool can be found at: http://www.ll.unimaas.nl/polaris/index_english.htm.

each others contributions, building on the lines of thought of a colleague, or just considering the proposition of a participant critically, or casting doubt on it.

Next to information on the title, author and date on which the contribution has been added, information is offered on the type of contribution by means of a symbol. A symbol in the column with a question mark, tells you that in this very contribution a question has been raised by the author. Next to add contributions, participants can also agree upon documents (and their attachments). The last column provides information on how many participants agreed on the same document. This information has been used to evaluate the patterns the SIG's have been working on.



After the patterns were evaluated and rewritten, they were published on the E-len website. It was also possible to add and rate patterns directly here. An example of one of the repositories is presented in the next picture.

Time Schedule
From September 2003 the SIGs have been brainstorming to accumulate as many problems as possible. The group chose the topics for writing design patterns or research patterns. After agreement on these, SIG-members worked on the topics (until May 2004). From May 2004 the content interactions of the SIGs have been compiled and the design patterns and research patterns have been analyzed and constructed (until July 2004).

Evaluation/feedback on patterns
After the main production of patterns, a feedback cycle was initiated to review and improve the patterns on a conceptual level. The evaluation on the conceptual level is of importance, as it is the basis for the successful implementation of the e-learning design patterns. The method followed for this evaluation level was expert rating. This evaluation was carried out within an other E-LEN work package (2).

All E-LEN partners were involved in the evaluation of the e-learning design patterns. The discussions took place in the E-LEN-all forum on the website. The patterns were rated within or rather as a result of the discussion by the “star system”. Next to this, partners were giving textual feedback on each category of the pattern, following the pattern format also while evaluating. After a certain period, the results of this feedback cycle were analysed, using the discussion logs from the forum. These discussions outcome were also summarized.

Methods

In order to evaluate participation (process of writing design patterns) and outcome (products or patterns), all interaction within the POLARIS environment has been analyzed. As is the aim for collaboration in online communication, the E-len project aimed at genuine interaction among the participants and the synthesis of collaborative work into a unified whole.

The content of the communication and work environment POLARIS and a survey of the working process were the input to answer the following questions in this evaluation:

How was the pattern development process organized and what were the effects of this organization in terms of :

- productivity;
- level of participation;
- and the content of communication among project partners?

How were the design patterns developed by the project partners, from the perspective of :

- validation;
- the used format;
- and the content that was handled?

For coding the discussions a procedure developed by Ingram and Hathorn (2004) has been used. They distinguish three factors which they see as characteristic for collaboration:

1. Interdependence as the pattern of participation and interaction in the group
2. Independence as autonomous actions of students
3. Synthesis as the creation of something new

The coding itself was done within the hermeneutic program ATLAS.

Quantitative analysis of communication: coding the forums in POLARIS

Firstly, the forums are described in numbers: number of threads, number of isolated messages, total number of messages within threads, number of agreed upon messages and number of accordations.

The definitions of the terms used are:

- Thread: a series of related messages
- Isolated messages: messages which are not followed up by another message
- Messages within a thread: all messages within threads (including start-messages)
- Accorded messages: messages which were agreed upon by using the 'thumbs up'-button in Polaris
- Total of accorded messages: number of persons who agreed upon a message by using the 'thumbs up'-button in Polaris

Variables and categories used were:

Participation		Number of messages produced
Place in thread	Isolated message	Note: sometimes the conversation continues. Being isolated in the thread does not necessarily mean independent.
	First message	Start of a thread
	Reaction	

Qualitative analysis of communication

Subsequently all messages have been arranged chronologically in order to track the ongoing conversation. Each message then was read and statements (within each message) were coded with means of a scheme in order to determine nature and quality of collaboration. Characteristics in this scheme are interaction (and interdependence), content and quality of the message.

Variables and categories used were:

Content of the message[2]	On task	
	Off task	
Connection to previous message	Direct response	Simple agreement, repeating a statement or answering a direct question
	Direct comment	Adding information or comments to the interaction
	Indirect comment	New idea or comment added to the interaction but connection to prior interaction is not clear
	No connection: new information	New idea or comment added to the interaction
Quality of interaction[3]	Simple agreement	Repeating information, simple agreement or disagreement without adding arguments
	Adding information	Adding to the statement, disagreeing or adding new information
	Synthesis of information	Synthesizing the information, creating a new idea (based on prior remarks).

[2] Within one message both on task as well as off task statements can be present
[3] Sometimes no label concerning the quality of the statement can be added

Quantitative and qualitative analysis of design pattern production

In order to write patterns aiming to support of both teachers and educational software designers in implementing ICT to support teaching or learning processes, a web-search using the following entries was executed:

Collaborative learning &	Problems Pitfalls Questions Issues Difficulties

Based upon the list for possible patterns, the produced patterns (outcome of this project), and the references to (ideas for) patterns or indicated research questions within patterns, a research roadmap was created.

A first step in evaluating the patterns is describing the production of patterns and their format and scope (as for whom they meant and on what topic they focus). Hereto all patterns are read and scored in terms of:

- **Category**: the patterns can either be written from a technical point of view (in order to provide definitions on how and what to develop concerning educational tools) or pedagogical (how to adapt educational circumstances in order to optimize use of e-learning tools).
- **Target group**: most of the time this perspective leads to the target group who is assumed to make use of the pattern.
- **Format**: the format of all the patterns is equal: they are all constructed based on the E-len format (for a description go to pages 6-7).
- **Method**: next interesting point is the method which has been chosen to write the patterns. Possible methods were inductive or deductive. These procedures are described in the *"Design patterns for collaborative learning: from practice to theory and back"* paper[4].
- **Keywords**: the keywords (describing the theme of the pattern) were also incorporated in the previously described research road map.

[4] paper presented at the Edmedia 2004 conference in Lugano by Baggetun, Rusman and Poggi.

Results

Quantitative analysis of design pattern production (product)

All the SIG's together produced 34 patterns 13 are written and stored in the communication tool, 21 in the E-len pattern repository.

Next table shows information on the content of the patterns.

Category	technical	19
	pedagogical	9
	mix	6
Format	E-len	34
	Alexander	0
Method	inductive	7
	deductive	16
	inductive/ deductive	11
Target group	technical	24
	educational	10
Keywords	Communication	4
	Workspace	12
	Organization of group work	9
	Learning support	7
	Assessment	2

Most patterns belong to the technical category. Regarding the target group technical users (for instance system engineers) are the main audience, followed by educational users (like instructors, moderators or learners).
Regarding the use of a format evaluation showed that most authors of patterns would rather have made use of an Alexander format (in stead of the E-len format).
The authors were questioned about the method they used and most patterns seem to have been built by describing or imagining real life situations. By searching for theory based arguments or research based proofs, the used solutions are generalized for broader use. Most patterns seem to be based on a mix of deduction and induction.
And focusing on the keywords, most attention is paid to patterns on computer supported collaborative learning. All patterns focus on one or two of five keywords (communication, assessment, learning support, organizing group work and work space).

In Attachment B you can find a table providing information on every pattern.

Qualitative analysis of design pattern production (product)

The web-search resulted in a list of articles (on research and experiences). Studying the articles, 45 questions and remarks have been raised which focused the E-len partners to topics to write patterns on. See the text-box for the questions.

1. When poorly structured, Web discussions can bore or alienate students, veer off topic and even hinder students' learning.

2. Students are quickly overwhelmed by too much information. When teachers fail to organize conversations, participants become confused.

3. Student comments lack justification. They often make assertions without providing evidence.

4. Students seldom connect their online comments to specific course concepts because they don't realize they're expected to, and they tend to speak anecdotally. Comments are often unrelated to course readings, theories or research topics discussed in class.

5. It's difficult to form a "community of learners" online. Because students can't see each other, it takes time for them to build trust and speak freely.

6. Web postings are time-consuming to grade. Students often post large amounts of text, making it hard for instructors to keep up.

7. In fact some of the key minuses of collaborative learning activities is that it takes too much time and produces very little visible results.

8. Most groups are aimless at the start

9. Many group discussions ended up straying off-task and wasting precious curriculum time.

10. My collaborators may not be able to respond immediately due to other priorities that they may have or to the lack of access to email.

11. Some individuals, may however, not do their share of work and hence have nothing to contribute to the group. They would just take a free ride from others in group, claiming credit for the group's work while not having contributed anything.

12. Tutors can become concerned that the cover of material is insufficient or moving off the 'right' areas of study.

13. The ambiguity of being a mentor rather than a didactic influence can cause insecurity for both staff and students.

14. Students' perception of assessment has a crucial influence on the approach taken to learning.

15. Structural relationships relating to 'real living' constraints (i.e. real, living students time scheduling) is an overbearing and comprehensive constraint on the ability of groups to work effectively together; work, home and social pressures are major cause of 'free riding'.

16. After years of working independently and competitively, they may find cooperation and collaboration difficult concepts to accept in an academic setting.

17. Conflicts within the groups

18. How do I grade collaborative work?

19. User do not have an appropriate framework for understanding how groupware technology differs from other, more familiar technologies (e.g., spreadsheets or e-mail) and this prevents them from taking advantage of the new technology's true potential.

20. The disparity between who does the work and who gets the benefit. A groupware application never provides precisely the same benefit to every group member. A groupware application is expected to provide a collective benefit, but some people must adjust more than others.

21. Social and motivational factors. Groupware may be resisted if it interferes with the subtle and complex social dynamics that are common to groups.

22. Use of groupware is able to enhance collaboration only in organisations that have an inherently collaborative culture.

23. The emergence of a cognitive conflict does not guarantee conceptual advancement because it may be taken as a paradox and resolved by ignoring one of the conflicting elements.

24. Interaction tools are needed that are adequately related both to the new concepts to be learned and to the previous experience and knowledge of the students

25. Many interactive www applications make it possible for the users to write their own comments in the document but offer little structure for the posted messages. Each new message is simply added after the previous messages.

26. Several of the recently developed www-based conferencing systems offer such threading, but there are also examples of systems which are too strictly structured to be accepted
by the majority of users

27. One problem noted by many WIT users was that each article is forced to either "agree" or "disagree.

28. Every branch off a topic is labeleda "proposal." But some topics need to branch into subtopics rather than proposals.

29. What is the added value of computers in collaborative learning environments?

30. The general passivity and uneven distribution of participation are common.

31. There is no study systematically comparing the impact of different CSCL tools. A careful analysis of the differences between more and less successful applications could provide better guidelines for developing new tools for different pedagogical situations.

32. Central to the group activity are social, motivational, and emotional factors that are difficult to implement in computer applications.

33. Much group work fails in class because teachers do not know how to plan for it.

34. Fear that not all of the syllabus material will be covered

35. Students may resist a more active role

36. Poor student small-group social skills

37. Assessment seen as problematic - group or individual - pitfalls

38. Too large groups - groups of larger than 4 or 5 means that some learners do not contribute sufficiently.

39. Starting too big - Do not conduct your first co-operative group work sessions on a large scale.

40. Bright students complain about begin held back by their slower team mates, weaker or less assertive students complain about being discounted or ignored in group sessions, and resentments build when some team members fail to pull their weight.

41. When students work in pairs, one of them tends to dominate.

42. Difficult to keep everyone involved in the process.

43. The drawbacks of a group with only weak students are obvious, but having only strong students in a group is equally undesirable.

44. Teams having difficulty working together.

45. Some students will "hitchhike," getting credit for work in which they did not actively participate.

The proposed list of 45 problems was subsequently clustered according to five themes:

1. (online) group problems	• It's difficult to form a "community of learners" online. Because students can't see each other, it takes time for them to build trust and speak freely. • How can group cohesion be build? • In fact some of the key minuses of collaborative learning activities is that it takes too much time and produces very little visible results. • Many group discussions ended up straying off-task and wasting precious curriculum time. • Most groups are aimless at the start • Some individuals, may however, not do their share of work and hence have nothing to contribute to the group. They would just take a free ride from others in group, claiming credit for the group's work while not having contributed anything. • Structural relationships relating to 'real living' constraints (i.e. real, living students time scheduling) is an overbearing and comprehensive constraint on the ability of groups to work effectively together; work, home and social pressures are major cause of 'free riding'. • Some students will "hitchhike," getting credit for work in which they did not actively participate. • The general passivity and uneven distribution of participation are common. • After years of working independently and competitively, they may find cooperation and collaboration difficult concepts to accept in an academic setting. • Conflicts within the groups • The disparity between who does the work and who gets the benefit. A groupware application never provides precisely the same benefit to every group member. A groupware application is expected to provide a collective benefit, but some people must adjust more than others. • Social and motivational factors. Groupware may be resisted if it interferes with the subtle and complex social dynamics that are common to groups. • How do we keep participants in CSCL motivated? • Much group work fails in class because teachers do not know how to plan for it. • Students may resist a more active role • Poor student small-group social skills • How is the composition of the group organized? • Too large groups - groups of larger than 4 or 5 means that some learners do not contribute sufficiently. • Bright students complain about begin held back by their slower teammates, weaker or less assertive students complain about being discounted or ignored in group sessions, and resentments build when some team members fail to pull their weight. • When students work in pairs, one of them tends to dominate. • Difficult to keep everyone involved in the process. • The drawbacks of a group with only weak students are obvious, but having only strong students in a group is equally undesirable. • Teams having difficulty working together.
2. communication problems	• When poorly structured, Web discussions can bore or alienate students, veer off topic and even hinder students' learning. • Many group discussions ended up straying off-task and wasting precious curriculum time. • My collaborators may not be able to respond immediately due to other priorities that they may have or to the lack of access to email. • Interaction tools are needed that are adequately related both to the new concepts to be learned and to the previous experience and knowledge of the students • Many interactive www applications make it possible for the users to write their own comments in the document but offer little structure for the posted messages. Each new message is simply added after the previous messages • Moderating online discussions • How can misunderstandings in communication can be detected and solved?
3. teacher/tutor problems	• Making a digital archive. • When poorly structured, Web discussions can bore or alienate students, veer off topic and even hinder students' learning. • Students are quickly overwhelmed by too much information. When teachers

	fail to organize conversations, participants become confused. • Tutors can become concerned that the cover of material is insufficient or moving off the 'right' areas of study. • The ambiguity of being a mentor rather than a didactic influence can cause insecurity for both staff and students. • Much group work fails in class because teachers do not know how to plan for it. • Fear that not all of the syllabus material will be covered • Starting too big - Do not conduct your first co-operative group work sessions on a large scale. • How can tasks be designed in a way that they promote interaction and collaboration?
4. assessment problems	• PBL & testing • Test construction • Forms of assessment • Peer-assessment • E-portfolio • Blackboard and (block) evaluation • Students' perception of assessment has a crucial influence on the approach taken to learning. • How to grade collaborative work? • Assessment seen as problematic - group or individual - pitfalls • How to monitor personal learners progress within a group? • How can the amount of learning-related interactions be improved/increased?
5. miscellaneous problems	• Variation of text and other material (concerning learning) • Multimedia • Student comments lack justification. They often make assertions without providing evidence. • Students seldom connect their online comments to specific course concepts because they don't realize they're expected to, and they tend to speak anecdotally. Comments are often unrelated to course readings, theories or research topics discussed in class. • Web postings are time-consuming to grade. Students often post large amounts of text, making it hard for instructors to keep up. • Users do not have an appropriate framework for understanding how groupware technology differs from other, more familiar technologies (e.g., spreadsheets or e-mail) and this prevents them from taking advantage of the new technology's true potential. • Use of groupware is able to enhance collaboration only in organisations that have an inherently collaborative culture. • The emergence of a cognitive conflict does not guarantee conceptual advancement because it may be taken as a paradox and resolved by ignoring one of the conflicting elements. • Several of the recently developed www-based conferencing systems offer such threading, but there are also examples of systems which are too strictly structured to be accepted by the majority of users • One problem noted by many WIT users was that each article is forced to either "agree" or "disagree. • Every branch off a topic is labeled a "proposal." But some topics need to branch into subtopics rather than proposals. • What is the added value of computers in collaborative learning environments? • There is no study systematically comparing the impact of different CSCL tools. A careful analysis of the differences between more and less successful applications could provide better guidelines for developing new tools for different pedagogical situations. • Central to the group activity are social, motivational, and emotional factors that are difficult to implement in computer applications. • How can be made the most of from collaboration as a learning method within an e-learning environment? • How can be learned from cross-cultural differences through e-learning? • How can the e-learning environment be made familiar for everybody? • How can higher order learning skills (and self-direction) in e-learning environments be improved?

Subsequently the problems (often posed as a question) were split up in possible patterns (columns 1 and 2 in the scheme below). While describing cases from practice and searching for literature to find research proven solutions for problems to add to the patterns, one concluded that the themes are that much interrelated that they are hard to separate. Therefore the 45 problems are integrated within one scheme (resulting in 34 titles of possible patterns). Next scheme shows the outcomes of this project.

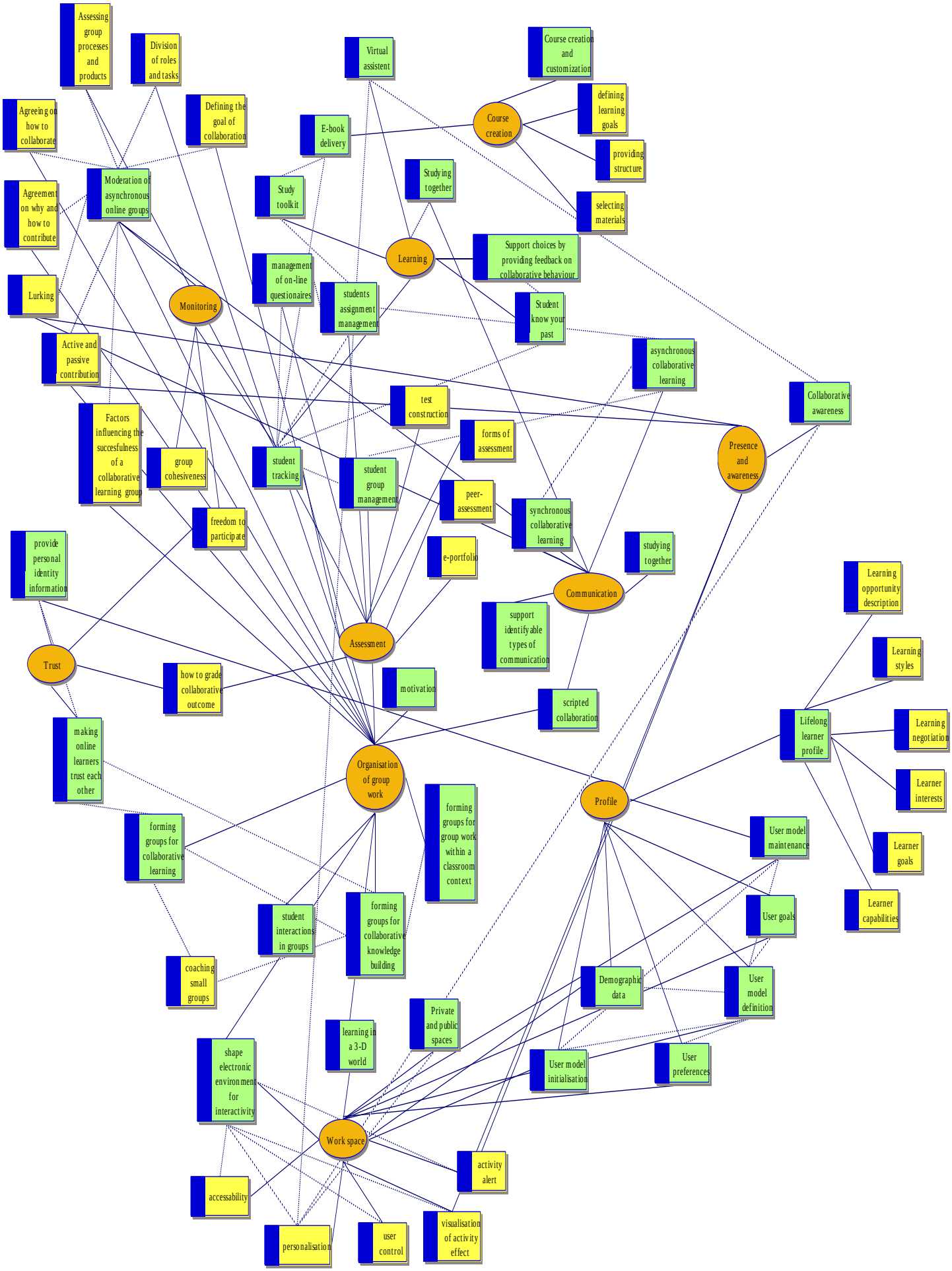
Problem(s)	Title of possible pattern	Products of E-len project
How can a 'community of online learners' be formed, with people that trust each other and feel they can speak freely?	Forming groups	1. Forming groups for collaborative learning 2. Forming groups for group work within a classroom context 3. Forming groups for collaborative knowledge building
	Making group members trust each other	4. Making online learners trust each other 5. Provide personal identity information
How can collaborative learning activities like for instance group discussions be created not being a waste of time and delivering visible results?	• Defining the goal of collaboration • Agreeing on how to collaborate • Agreements on why and how to contribute	6. Studying together
How to make all the participants contribute equally?	• Division of roles and tasks • (peer)Assessing group processes and products • Active and passive contribution • Lurking	7. Collaborative awareness 8. Motivation
How to make students (people) cooperate and collaborate after years of working independently and competitively?	• Factors influencing the successfulness of a group for collaborative learning • Offer proper tools for communication/ collaboration / cooperation	8. Asynchronous collaborative learning 9. Synchronous collaborative learning 10. Shape electronic environment for interactivity 11. Scripted collaboration 12. Support identifiable types of communication
What role and task does the teacher have?	• defining learning goals • creating assignments (projects, cases, etc.) • providing structure • coaching and monitoring the process • how can the amount of learning-related interactions be improved/increased? • selecting materials (sources, tools) • Moderating affects group cohesiveness and freedom to participate	13. Moderation of asynchronous online groups 14. E-book delivery 15. Course creation and customization 16. Support choices by providing feedback on collaborative behaviour 17. Student group management

How and what to assess?	• Test construction • Forms of assessment • Peer-assessment • E-portfolio • How to grade collaborative work? • Monitoring of personal learners progress within a group?	18. Management of on-line questionnaires 19. Student tracking 20. Student Assignments Management
How to take differences of participants into account?	• learning styles • experiences in collaboration/ cooperation • individual (personal) characteristics • benefits of the collaboration process • Students' perception	21. Study toolkit 22. Lifelong learner profile 23. Demographic data 24. Student know your past 25. Support identifiable types of communication 26. Private and public spaces 27. Virtual assistant 28. Learning in a 3-D world 29. User goals 30. User model definition 31. User model initialisation 32. User model maintenance 33. User preferences

Research roadmap production

Based upon the list for possible patterns (column 2), the produced patterns (column 3), and the references to (ideas for) patterns or indicated research questions within patterns, a roadmap was created. This roadmap contains produced patterns as well as potential patterns, which are in fact the research questions for the future and together form a research roadmap for the future.

The colour shows the status: green ones already exist (patterns attached to this report); yellow ones are still under construction or not yet explored. The lines between the boxes refer to links between the patterns and can thus be regarded as the pattern language.


Assessing group processes and products
Division of roles and tasks
Virtual assistent
Course creation and customization
Agreeing on how to collaborate
Defining the goal of collaboration
E-book delivery
Course creation
defining learning goals
providing structure
Moderation of asynchronous online groups
Study toolkit
Studying together
Agreement on why and how to contribute
selecting materials
Learning
Support choices by providing feedback on collaborative behaviour
management of on-line questionaires
Lurking
Monitoring
students assignment management
Student know your past
Active and passive contribution
asynchronous collaborative learning
Collaborative awareness
test construction
Factors influencing the succesfulness of a collaborative learning group
forms of assessment
Presence and awareness
group cohesiveness
student tracking
student group management
peer-assessment
synchronous collaborative learning
freedom to participate
provide personal identity information
e-portfolio
studying together
Communication
Learning opportunity description
support identifyable types of communication
Assessment
Learning styles
Trust
how to grade collaborative outcome
motivation
scripted collaboration
Lifelong learner profile
Learning negotiation
making online learners trust each other
Organisation of group work
Profile
forming groups for group work within a classroom context
Learner interests
forming groups for collaborative learning
User model maintenance
Learner goals
student interactions in groups
forming groups for collaborative knowledge building
User goals
Learner capabilities
coaching small groups
Demographic data
User model definition
Private and public spaces
learning in a 3-D world
shape electronic environments for interactivity
User model initialisation
User preferences
Work space
activity alert
accessability
visualisation of activity effect
personalisation
user control

Quantitative analysis of the forums (process)

Next table represents data of the forums with content[5]. The 'start forum' which was used to introduce the participants to each other, is not taken into account in this overview. This 'Start forum' was important to get to know each other a bit, which is important for collaboration, but within this forum no content was created.

	Number of messages	**Number of isolated messages**	**Number of threads**	**Total number of messages within threads**	**Accordated messages**	**Total of accordations**
E-LEN ALL Total	84	17	16	67	9	12
SIG 1 Total	42	4	8	38	0	0
Forum 1	24	3	5	21	0	0
Forum 2	13	1	1	12	0	0
Forum 3	5	0	2	5	0	0
Forum 4	0	0	0	0	0	0
SIG 2 Total	25	14	5	11	6	9
Forum 1	15	8	3	7	5	8
Forum 2	3	1	1	2	1	1
Forum 3	7	5	1	2	0	0
SIG 3 Total	59	6	10	53	21	37
Forum 1	7	1	2	6	3	5
Forum 2	52	5	8	47	18	32

The definitions of the terms used in the headings of this table are:

- Thread: a series of related messages
- Isolated messages: messages which are not followed up by another message
- Messages within a thread: all messages within threads (including start-messages)
- Accordated messages: messages which were agreed upon by using the 'thumbs up'-button in Polaris
- Total of accordations: number of persons who agreed upon a message by using the 'thumbs up'-button in Polaris

[5] SIG 4 did not communicate in the POLARIS environment. This group used the E-LEN platform directly for the distribution of the results.

Qualitative analysis of the forums (process)

Next few tables provide an overview of the content of the messages giving an impression of the interaction in the forums and thus of the quality of the collaboration.

	SIG 1	SIG 2	SIG 3	E-len-all
On task	47	30	68	82
Off task	16	3	10	5

Messages can contain both on task and off task statements. Most off task statements were present in the start forums, in which the participants exchanged information about affiliation and personal life to create group cohesiveness.

	SIG 1	SIG 2	SIG 3	E-len-all
Direct response	21	6	24	20
Direct comment	31	11	39	44
Indirect comment	4	0	17	9
New information	5	20	21	15

The messages could also contain more then one type of statement describing (amount of) interaction by means of making visible the relation of a statement to a previous message. The table on page 13 indicates the meaning of each code. In short: the more *direct responses and comments* the more building on each others contributions is present. Comments show most profound interaction.

	SIG 1	SIG 2	SIG 3	E-len-all
Simple agreement	15	8	21	28
Adding information	38	29	61	69
Synthesis	5	4	26	17

Most contributions contained new information on a topic. Synthesis was least present (mostly in the forums in which patterns were posed and commented). Not visible in these data is synthesis which took place within the attachments: authors integrated comments of reviewers in newer versions of patterns.

Conclusions and discussion

Productivity

The total amount of developed and discussed design patterns is 34, in three different categories. 19 patterns were categorized as technical, 9 patterns as pedagogical and 6 patterns are a combination of both. From the perspective of integrating technology in a pedagogical context this result makes clear how difficult it is to work interdisciplinary in e-learning design.
The detailed structure of the E-Len pattern format, deviating from Alexanders' original pattern structure, might have caused this result. Such a detailed structure can lead to more detailed and subsequently more mono-disciplinary problem statements.

A short additional survey among pattern writers after the production process learned that most participants preferred a middle-out strategy during development. Patterns have in essence an empirical basis. It means, they are written in bottom-up direction in the beginning phase, and tuned in validating them to experiences by others or to available theories and models of learning. In particular the normative and prescriptive quality of design patterns can be strengthened in group communication.

Production process

A quantitative analysis of the interactions among participants in different SIG's showed a higher level of on-task than off-task interaction. However, from the perspective of productivity, analyzing the interaction patterns in the work environment, we also found a substantial number of isolated messages. This means that productivity could have reached a higher level if communication was intensified, from a quantitative as well as from a qualitative perspective.

A qualitative analysis of the interactions showed that a proportional high number of messages were direct related responses to messages before. Available functionality to summarize and synthesize incoming information is sparsely used by participants. In this test bed the development of design patterns was organized as a group process of knowledge building. Individual articulated knowledge is shared and revalued in group communication.

Looking at the organization of the pattern production process we conclude that the moderator and the communication tool have a strong influence on productivity in asynchronous knowledge building. Isolated messages and unfinished threads without conclusions were found in all SIG forums that were screened in this analysis. From evaluation studies of group processes is known that moderators can have a significant role in this, when they observe interaction patterns and take action to facilitate the process.

References

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

Alexander, C., Ishikawa, S., Silverstein, M.(1977). A Pattern Language: Towns, Buildings, Construction. New York: Oxford University Press.

Avgeropiou, P., Papasalouros, A., Retalis, S.(2003). Patterns for designing Learning Management systems. European Pattern Languages of Programming (EuroPLOP) 25th-29th June 2003, Irsee, Germany. [Available online]: http://www2.tisip.no/E-LEN/papers/LMSdespatternsVfin.pdf

Avgeriou, P., Papasalouros, A., Retalis, S., Skordalakis, E.(2003). "Towards a Pattern Language for Learning Management Systems", Educational Technology & Society, ISSN 1436-4522, Volume 6, Issue 2, pp. 11-24, 2003 *Available at http://ifets.ieee.org/periodical/6-2/2.html (ISSN 1436-4522)*

Baggetun, R., Retalis, S., et.al. (2003). Design patterns for CSCL. Workshop proposal. Bergen: CSCL 2003

Bergin, J. (last updated 2004). http://csis.pace.edu/~bergin/

Bergin, J.(last updated 2002). Fourteen pedagogical patterns.[Available online]: http://csis.pace.edu/~bergin/PedPat1.3.html

Coplien, J.O. (1999). A pattern language for writers'workshops. Lucent Technologies. http://www.bell-labs.com/user/cope/Patterns/WritersWorkshops/

Frizell, S., Hubscher, R. (2002). Supporting the Application of Design Patterns in Web-Course Design, Ed-Media 2002. [Available online]: http://www.auburn.edu/~frizess/frizell-edmedia.pdf

Frizell, S., Hubscher, R. (2002). Aligning Theory and Web-based Instructional Design Practice with Design Patterns, E-Learn 2002. [Available online]: http://www.auburn.edu/~frizess/frizell-elearn.pdf

Gamma, E., Helm, R., Johnson, R., Vlissides, J. (1994). Design Patterns, elements of reusable object-oriented software. Boston: Addison-Wesley professional computing series.
Gunawardena, C. N., Lowe, C.A., Anderson, T. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *Journal of educational computing research*, 17(4), 397-431

Harrisson, N.B. The language of shepherding. A pattern language for shepherds and sheep. [Online]. http://www.mcs.vuw.ac.nz/~kplop/Shp.html

Hillside.net (2003). [Available online]: http://hillside.net/patterns/

Inaba, A., Ohkubo, R., Ikeda, M., Mizoguchi, R., Toyoda, J.
An Instructional Design Support Environment for CSCL Fundamental Concepts and Design Patterns
http://www.ei.sanken.osaka-u.ac.jp/pub/CSCL/inaba-AIED01.PDF

Ingram A.L. & Hathorn, L.G. (2004). Methods for analyzing collaboration in online communications. In T.S. Roberts (Ed.): *Online collaborative learning: theory and practice*. Information Science Publishing, Hershey (USA) & London (UK).

Lea, D. [maintained by]. http://gee.cs.oswego.edu/dl/pd-FAQ/pd-FAQ.html

Meszaros, G., Doble, J. (2003). A pattern language for pattern writing. http://hillside.net/patterns/writing/patterns.htm

Pattern language, an association of people from all walks of life. [Available online]: http://www.patternlanguage.com/

Paulsen, M. (1995). *The on-line report on pedagogical techniques for computer-mediated communication*. Available: http://www.nki.no/~morten

Pedagogical patterns, the pedagogical patterns project. Retrieved 2003. [Available online]: http://www.pedagogicalpatterns.org/

Pointer project. [Available online]: http://www.comp.lancs.ac.uk/computing/research/cseg/projects/pointer/pointer.html

Prechelt, L., Unger, B., Tichy, W., Brössler, P.(2001). A controlled experiment in maintenance comparing design patterns to simpler solutions. IEEE Transactions on Software Engineering, 27(12):1134-1144, December 2001.

Salingaros, N. Some notes on Christopher Alexander. [Available online]: http://www.math.utsa.edu/sphere/salingar/Chris.text.html

Saunders, R.(2001). Pattern language by Chrisopher Alexander. [Available online]: http://www.arch.usyd.edu.au/~rob/study/PatternLanguage.html

Schümer, T. Patterns 4 groupware. Retrieved 2003. [Available online]: http://www.groupware-patterns.org/

Schümer, T.(2003). Some notes taken from Alexander's 'Timeless Way of Building'. http://wwwpi6.fernuni-hagen.de:8080/gw-patterns/23

About E-LEN

E-LEN is a European network of institutions with e-learning expertise. The network was established to share and develop information and design patterns regarding e-learning. An important activity of the network is the dissemination of design patterns to interested parties.

The E-LEN project is part-funded by the European Union through the Minerva programme. The E-LEN partners are:

- University of Cyprus (co-ordinator)
- The Learning Lab, University of Maastricht (NL)
- CSALT, University of Lancaster (UK)
- A Priori Ltd (UK)
- Ilmenau Technical University (DE)s
- Hypermedia Open Center – Politecnico di Milano (IT)
- InterMedia, University of Bergen (NO)
- NITOL (NO)
- National Technical University of Athens (GR)
- Open University of the Netherlands (NL).

Attachments

Attachment A: **Overview of position papers**

Towards a Pattern Language for Learning Management Systems (SIG 1)

Paris Avgeriou[1], Andreas Papasalouros[1], Symeon Retalis[2], Manolis Skordalakis[1]

1- National Technical University of Athens
Department of Electrical and Computer Engineering
Software Engineering Laboratory, 15780 Zografou, Athens, GREECE
E-mail: {pavger, andpapas, skordala}@softlab.ntua.gr

2- University of Cyprus
Department of Computer Science
75 Kallipoleos Str., P.O. Box 20537CY-1678 Nicosia, Cyprus
Email: retal@cs.ucy.ac.cy

Abstract
Learning Management Systems are sophisticated web-based applications that are being engineered today in increasing numbers by numerous institutions and companies that want to get involved in e-learning either for providing services to third parties, or for educating and training their own people. Even though the construction of such systems has been taking place for many years, they are still designed and developed from scratch. The reason is that experience from previous Learning Management Systems, is not codified or documented, resulting in forcing the development teams to 're-invent the wheel'. This paper presents an approach of recording design experience in the form of design patterns for Learning Management Systems and aims at developing a pattern language for these systems.

KEYWORDS: Design Patterns, Pattern Language, Patterns System, Learning Management Systems, e-Learning, Learning Technology Systems.

Introduction

Learning Management Systems (LMS) are specialized Learning Technology Systems (IEEE LTSC, 2001a), based on the state-of-the-art Internet and WWW technologies in order to provide education and training following the open and distance learning paradigm. The design and implementation of such systems is not an easy task, since they are complex systems that incorporate a variety of organizational, administrative, instructional and technological components (Moore & Kearsley, 1996; Carlson, 1998). Therefore systematic, disciplined approaches must be devised in order to leverage the complexity and assortment of LMS and achieve overall product quality within specific time and budget limits. One such approach is the use of design patterns, so that these systems will not be designed and implemented from scratch, but based on reusable design experience gained over several years of try-and-error attempts.

Experienced designers know how to solve certain problems because they have seen them appearing repeatedly and have developed design patterns implicitly. These implicit design patterns are in practice what separates the experienced designer from the novice one. According to (Alexander et al., 1977): "each 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". Patterns are not conceived in a big bang but rather discovered or mined after numerous implementations of the same solution in a given problem, usually by different people. It is more or less a

process of reverse-engineering the systems that embed good design in order to make that design explicit, and be able to communicate it to other designers, so that it becomes common practice.
Alexander has also proposed the notion of a *pattern language*, which is a collection of related patterns that captures the whole of the design process and can guide the designer through step-by-step design guidelines. This concept is also known as *system of patterns*, a term introduced in (Buschmann et al., 1996). Even though there are some differences between these terms, they are often used interchangeably to denote a set of related patterns that collaborate inside the boundaries of an application domain (Lyardet et al., 1998).

Patterns are all about reusability, which seems to be the keyword in achieving the economies of scale for building affordable software systems. Reuse in the form of analysis, design, or architectural patterns, is even more important than simple code reuse (Rossi et al., 1997; Ericsson & Penker, 2000). A further advantage that patterns promote is independence of methodologies, methods, processes, models and languages (Buschmann et al., 1996; Rossi et al., 1997; Garzotto et al., 1999; Nanard et al., 1998). In that sense, patterns are a pervasive, horizontal reuse strategy that can illustrate a recurring problem and its solution in a neutral manner. Their field of application is extremely broadened in this sense.

The history of patterns and their proliferation is well known and broadly documented. It all began in the field of building architecture, when Christopher Alexander invented the idea of capturing design guidelines in the form of design patterns (Alexander et al., 1977). The 'Alexandrian' patterns found many followers in the computer science discipline, especially after the so-called 'GOF' book for object-oriented design (Gamma et al., 1994). Some of the fields that have adopted patterns are: software architecture (Buschmann et al., 1996; Schmidt et al., 2000), hypermedia engineering (Rossi et al., 1996), object-oriented analysis (Fowler, 1998), business modeling (Eriksson & Penker, 2000), Human-Computer Interaction (Borchers, 2001), e-business patterns (http://www.ibm.com/framework/patterns) and patterns for specific programming languages such as Java (Cooper, 2000; Alur, 2001). The last years, we have even watched the idea of recording not only patterns but also *anti-patterns* (http://www.antipatterns.com/) (Brown, 1998): what usually goes wrong in software development and how one can avoid these mishaps. This list is certainly not exhaustive but does indicate the paramount importance of patterns and their adoption in a wide array of disciplines.

Several repositories of patterns exist for various disciplines and offer design expertise reuse to the corresponding communities. The object-oriented software community documents the design patterns initiated in (Gamma et al., 1994), in the "PLoP" (Pattern Languages of Programs) series of conferences (http://jerry.cs.uiuc.edu/~plop/) that followed as well as their clones in various parts of the world such as EuroPLoP, KoalaPLoP, SugarLoafPLoP etc. (see http://www.hillside.net/patterns/). The hypermedia community and particularly the ACM-SIGWEB have established their own repository of design patterns that is mostly originated in the official hypermedia design patterns web site (Hypermedia Design Patterns Repository, 2002). The HCI community has also launched a repository of design patterns that are discussed and recorded in workshops, conferences and web sites, like (HCI patterns web site, 2002). On the contrary, the e-learning community even though is aware of patterns and their advantages, has not yet initiated a similar attempt to establish a formal repository of patterns for its own domain.

This paper aims to move research steps towards that direction by proposing an initial set of design patterns for Learning Management Systems. The patterns in this paper are meant to work synergistically and become part of a *pattern language* for Leaning Management Systems. As in other pattern languages proposed, the patterns of this paper are not new and certainly not innovative, they have been incorporated in LMS for years now. Instead the intention of this form of pattern languages is merely to capture design expertise and present it in a comprehensible and usable format (Lyardet et al., 1999). In this way, designers of new or existing LMS, especially inexperienced designers, can take advantage of previous design expertise and save precious time and resources.

The structure of this paper is as follows: Section 2 analyses the context of LMS for the application of design patterns by emphasizing on its unique characteristics that affect the definition of the patterns. Section 3 provides the catalog of patterns described according to a specific template. Finally section 4 wraps up with conclusions and ideas for future work.

The context of LMS Design Patterns

Learning Management Systems are in essence hypermedia systems, and as such can take advantage of design patterns in that area, since there is a significant amount of work already completed in that field (Hypermedia Design Patterns Repository, 2002). We strongly encourage the utilization of those patterns for the design and development of the interface, navigation and content of LMS. However in this paper we propose domain-specific patterns in the context of web-based learning that attempt to solve problems particular to LMS and as such, have not been addressed by hypermedia design patterns. It is noted though that the patterns proposed in this paper are related to some of the hypermedia patterns, as it will be shown later. Relevant research work has been conducted in (Lyardet et al., 1998), where the authors propose hypermedia design patterns that can be applied in educational multimedia applications. There is also a repository of patterns in the conventional learning and pedagogical discipline, mainly focused on teacher-based learning (Pedagogical Patterns Project site, 2002).

Learning Management Systems have been widely adopted by institutions and instructional designers in order to fulfill certain needs and requirements in a field of ever increasing demands for effective, fast and pedagogically correct education and training. LMS that are in use today are either commercial products (e.g. WebCT, Blackboard, Intralearn), open-source projects (e.g. FLE, http://fle3.uiah.fi/), or customized software systems that serve the instructional purposes of particular organizations. The users of LMS can been classified into three categories:

- The *learners* that use the system in order to participate through distance (in place and/or time) to the educational process. In fact, the learners are the focal users of LMS, in the sense that these systems are being developed in order to satisfy some of their needs and resolve their problems.
- The *instructors*, being the teachers and their assistants that use the system in order to coach, supervise, assist and evaluate the students (e.g. notify for important issues on an electronic notice board, engage in discussions in electronic fora, communicate and exchange personal messages with students, collect, assess and return deliverables, etc.).
- The *administrators* of the system, who undertake the support of all the other users of the system and safeguard its proper operational status.

According to (McCormack & Jones, 1997), an LMS offers services for satisfying specific instructional needs and/or automating (partially or fully) instructional events. LMS should support the development and execution of four basic tasks via a simple, friendly and uniform user-interface:

- *Information distribution*, e.g. announcing the tips of the day, calendar, glossary, etc.
- *Management of learning material*, e.g. customisation of the user interface to the needs of the instructor, updating the learning material, etc.
- *Offer of Multiple communication facilities*, e.g. asynchronous and synchronous communication.
- *Class management*, e.g. on-line marking of students' assessments, tracking learners' participation, management of learners profiles, etc.

If we consider these basic tasks as problems that designers of LMS have to solve, we can find the appropriate patterns in existing LMS that illustrate the solution to these problems. The methodology used in this paper for 'pattern mining' is governed by such a philosophy. In particular, we first analyzed the above basic tasks into more detailed features and then tried to discover these features in a number of real LMS that are broadly used. If these features were indeed found in at least three or four LMS, then these features were considered widely adopted and applicable and were therefore regarded as LMS design

patterns. The set of LMS that we used to mine the patterns is shown in Table 1. The next step was to describe them in a suitable format in a similar way to patterns of other domains.

Table 1: LMS that were searched for patterns

Name	**Company**	**URL**
WebCT	WebCT, Inc	http://www.webct.com
CoSE	Staffordshire University	http://www.staffs.ac.uk/COSE
LearningSpace	Lotus	http://www.lotus.com/home.nsf/welcome/learnspace/
BlackBoard	Blackboard	http://www.blackboard.com
TopClass	WBT Systems	http://www.wbtsystems.com
VirtualU	Virtual Learning Enviroments	http://www.vlei.com
FirstClass	Centrinity	http://www.firstclass.com
Zebu	Centrinity	http://www.mc2learning.com
Learnlinc	Mentergy	http://learnlinc.com
Intralearn	Intralearn	http://www.intralearn.com
Saba	Saba Software	http://www.saba.com
FLE	UIAH Media Lab	http://fle3.uiah.fi
Convene	Convene	http://www.convene.com
Gentle WBT	Hyperwave AG	http://wbt-2.iicm.edu

As eloquently stated in (Gamma et al., 1994), it is more difficult to describe patterns than to actually find them. Almost all of the approaches that have proposed patterns in a subject field, have also suggested a novel way of describing and cataloging them. Our suggestion for a pattern description format is a variation of the Alexandrian template that contains the following fields:

i. **Name** – a unique name to distinguish the pattern and uniquely refer to it.
ii. **Problem** – a brief description of the design problem at hand.
iii. **Motivation** – an explanation of the origins of the problem, probably with an example for better communicating it. It may also contain the context of the particular problem if it is necessary in order to make it more comprehensible.
iv. **Solution** – a description of the solution proposed by this pattern that addresses the problem and motivation stated earlier.
v. **User category** – one of the three categories of LMS users defined above.
vi. **Known uses** – examples of the pattern in real LMS. This is an important attribute of a pattern since it is claimed that a proposed pattern gets accepted by the corresponding pattern community, only if there have been two or three examples of its use by someone other than the one who suggested the pattern (Buschmann et al., 1996).
vii. **Related Patterns** – other patterns that are related to this one in some way. It is noted that the patterns proposed in this paper, except for being related to each other, are also related to hypermedia design patterns.

The Alexandrian format is a rather abstract way of describing patterns, as it does not delve into implementation details, but rather expresses a generic solution. On the contrary, the GOF format is very complete and provides straightforward guidelines for implementing the patterns into software. The reason for choosing the Alexandrian format rather than the GOF format, was that the patterns found in Learning Management Systems do not contain many implementation details, but are rather generic and abstract and can be implemented in several different ways. In addition we do not wish to deal with implementation issues because the technologies are changing too fast and if we attempt to propose specific technologies, they will soon become obsolete. The same practice is used in the hypermedia patterns (Rossi et al., 1997; Garrido et al., 1997; Rossi et al., 1999; Garzotto et al., 1999), as well as the HCI patterns (HCI patterns web site, 2002). The next section shows the application of this format for a number of LMS design patterns.

Catalog Of Patterns

Personalization

i. **Problem:** how can the different courses that users are involved in, be organized, so that each user is presented with her/his own personalized set of courses?
ii. **Motivation:** Users of a Learning Management System are involved in a number of courses, depending on the specific academic program they are involved in and their particular position. For example the student of a virtual university for an undergraduate degree, is usually enrolled in 4-8 courses per semester. Correspondingly a professor in a virtual university might teach two to four courses. Also people that act as tutors or teaching assistants of undergraduate courses, might themselves be students of post-graduate courses. All these users may access the courses they attend, teach or provide teaching assistantship to, in varied ways. They may choose for example a specific course from a set of courses, and according to their login information, they will have the corresponding rights and privileges. Another way is to categorize the access pages of different users and let, for example, instructors go to the instructors' access page and choose the courses they teach from a list of all the courses being taught. The problem with such approaches is that users have to trace the individual courses they are interested in through intermediate pages according to their role. Also they are presented with information that is irrelevant to them, for example they see all the courses that are being taught and not the ones that are of immediate interest to them. Another problem is that if they have different roles in different courses, they have to follow different access structures.
iii. **Solution:** Provide a personalization service for all the users, that customizes their home page according to a unique account. Through this service all users should enter the system through an initial login page, and once they are authenticated, they should be presented with all the courses they are involved in, irrelevantly to what their roles are in those courses. These personalization engines are usually named with the prefix 'my-', similarly to ones in common web sites, e.g. 'mySun' in http://mysun.sun.com/.
iv. **User category:** All users.
v. **Known uses:** WebCT and BlackBoard offer such personalization services called myWebCT and myBlackBoard.
vi. **Related Patterns:** Registration-authentication-access control, Course announcements, Information distribution.

Course announcements

i. **Problem:** Given a sizeable LMS with numerous courses and users, how can the users see the announcements about courses that are of interest to them?
ii. **Motivation:** In large LMS, users are involved with a number of courses and it is of paramount importance for them to see the announcements about courses that concern for example project delivery deadlines, on-line test dates, on-line lecture dates etc. This information must be visible in a place where the user is certain to see it independently of the task she/he wishes to perform when entering the LMS. For example if there is an important announcement about a mathematics course and the student only accesses the LMS to read her/his e-mail or access another course, she/he should also be able to see that announcement.
iii. **Solution:** Structure the initial page of the LMS so that the user as soon as she/he logs into the system, she/he will be able to see the announcements that are of relevance to the courses she/he is involved in. The announcements mechanism should also keep track of the announcements the user has already seen and properly flag the new ones.
iv. **User category:** All users

v. **Known uses:** WebCT and BlackBoard have embedded such a mechanism in the "my" personalization engines, that inform all users of the announcements that relate to the courses they are involved in.
vi. **Related Patterns:** Personalization, Student Assignments Management, Information distribution. This pattern is also related to the News hypermedia design pattern described in (Rossi et al., 1999), which describes the same mechanism for providing the latest news about a particular company in commercial web sites.

Pervasive references

i. **Problem:** How can users have access to various tools of the LMS from parts not directly related to them?
ii. **Motivation:** Learners that are studying the learning resources need to jump from one resource to the other seamlessly, even when the two resources are not directly related. For example learners reading the electronic book, often need to look up terms they come across in the dictionary or glossary. Or when learners are doing a self-assessment exercise and get stuck in a problem, they need to post a question in the discussion forum or find a colleague to chat about it. Even though this problem is more evident with learners, it applies quite equally to the other LMS user categories. For example when the instructor is adding an announcement about a new project assignment being posted, he/she also wants to do some file management in order to upload the files in the appropriate place.
iii. **Solution:** Define a set of pervasive references that are constantly visible from within an environment that is indirectly related to them. This is usually implemented with a toolbar that is placed on top or at the left of the page and users can contains all the tools that users may want to access during another task. It is also common practice to be able to customize this toolbar so that it will match one's preferences.
iv. **User category:** All users.
v. **Known uses:** All the LMS that were examined have incorporated the ability to add such pervasive references.
vii. **Related Patterns:** all the other patterns are related to Pervasive References since all the tools described by the patterns can act as pervasive references. This pattern is also related to the Landmark hypermedia design pattern described in (Rossi et al., 1999), which describes the same mechanism for providing easy access to different though unrelated subsystems in a hypermedia application.

Study toolkit

i. **Problem:** how can the learners be assisted in studying the learning resources instead of being limited to reading simple HTML pages?
ii. **Motivation:** There are many facets to this problem. A first one is that most learners find it difficult to study on-line material because they are used to particular methods of studying paper-based courseware and can't get accustomed to reading from the screen passively. When reading paper-based material, learners usually underline or highlight words or phrases, place bookmarks on particular pages, make annotations on the side etc. These functions obviously can't be performed on a plain web page and they need to be incorporated as an explicit service of the LMS. Another facet of this problem is that learners can't remain connected to the server for many hours for financial reasons (e.g. connection through a dial-up modem) or because they have problems with their connection (limited bandwidth, server down, network congestion). In this case the learners need to download the learning material, store it locally on their computer and use it whenever they want to. Of course this is not a simple download problem, since the learning material may be comprised of numerous pages, linked implicitly through the LMS navigational mechanisms, may have an LMS-

made table of contents etc. Finally another facet of this problem is that learners do not want to do on-line studying at all and would rather print the material and read it from paper. Once again this is not a simple download problem, as described earlier.

iii. **Solution:** Provide a study toolkit for the learners to use, which will facilitate them in studying the courseware according to their own preferences. Offer them a set of tools for creating annotations on the text, putting bookmarks on point of interest etc. Also provide them with a tool that 'compiles' the learning material in such a format that can be downloaded and stored locally, and another format that is printable.

iv. **User category:** Learners.

v. **Known uses**: WebCT, VirtualU, Blackboard, CoSE, Intralearn, TopClass, LearnLinc, FirstClass and LearningSpace provide the ability to set bookmarks, while CoSE, Intralearn, FirstClass and LearningSpace provide annotation tools. WebCT and BlackBoard provide the tools for 'compiling' the learning content in a downloadable and printable format.

vi. **Related Patterns:** E-book delivery, Glossary.

Searching

i. **Problem:** How can the users search through the learning resources and find something, effectively and without wasting too much time in irrelevant pages?

ii. **Motivation:** There are cases where the learning resources are numerous and diverse, resulting in the students spending much time and effort in trying to locate them. Browsing through the resources is therefore not the most effective way to find what one is looking for, in an educational context. Also the learners are often overburdened with information resulting in a cognitive overload in expense of the learning process.

iii. **Solution:** LMS should have the provision of incorporating search engines such as the ones found in generic web sites. These search engines though are differentiated from common web site search engines, in that they are specialized in learning resources and therefore can be smarter than common search engines. That can be achieved by adding contextual semantic information for learning resources in the form of *learning object metadata*, which describe relevant characteristics of learning objects in order to facilitate search, evaluation, acquisition, and use of learning objects, for instance by learners or instructors (IEEE LTSC, 2001b). There are several metadata standards (e.g. IEEE LTSC, IMS, Ariadne) that can be adopted by LMS so that these descriptions of learning resources can be formalized and even exchanged between them.

iv. **User category:** learners and instructors.

v. **Known uses:** Search engines that facilitate searching in the learning content are offered by WebCT, COSE, Intralearn and TopClass. None of them so far has adopted an international standard for learning object metadata, but some LMS have announced that they plan to do so. However COSE, TopClass, LearnLinc, Saba and LearningSpace support proprietary metadata formats to enable searching of learning resources.

vi. **Related Patterns:** Searching can apply to all learning resources, therefore this pattern is related to E-book delivery, Glossary, Course announcements. The patterns 'Selectable Search Space', 'Selectable Keywords', 'Structured Answer', 'Selectable Search Engine' and 'Simple Search Interface' (Lyardet et al., 1999) are relevant for providing guidelines on how to make effective search engines for Web Information Systems.

Course Creation and Customization

i. **Problem:** How can the instructors be assisted in building on-line courses in LMS so that some of the tasks they need to perform can be automated?

ii. **Motivation:** LMS need to make the job of instructors easier by providing them with easy-to-use tools for creating, and customizing their courses so that they won't have to be experienced in using the LMS, neither will they have to spend too much time and effort in performing those tasks. This way, courses will not be created from scratch, but instead instructors will reuse some design templates and easily perform generic activities and let the LMS take care of the details. For example if an instructor already has a course named 'Software Engineering: Part I' and wants to create another one for the course 'Software Engineering: Part II' that has roughly the same structure and format, she/he should not create it form scratch. Instead she/he should be able to build the new course by using the old one as a template. Also instructors should not have to perform low-level activities to customize their course but the LMS should provide the appropriate tools. For example if the instructor wants to change the background image of the course's home page she/he should not change the corresponding HTML tag, but instead set it visually through an LMS tool. Finally courses have to be initialized in the beginning of every semester in an automatic way by resetting student accounts, deleting the old announcements, reconfiguring the calendar, cleaning the old file folders etc.

iii. **Solution:** Provide the instructors with appropriate tools for creating a course and customizing it according to their preferences. The creation of courses should be based on design templates with pre-set interfaces, content structure and features or based on existing courses. Instructors should also be equipped with tools to reset the courses on every semester and easily manage the appearance, structure and features of their courses, doing as few things manually as possible.

iv. **User category:** Administrators and Instructors.

v. **Known uses:** WebCT, VirtualU, Blackboard, Intralearn, TopClass, LearnLinc, FirstClass, Convene and LearningSpace provide templates for course creation as well as tools for customizing the various courses characteristics.

vi. **Related Patterns:** Personalization, Course Initialization.

Student tracking

i. **Problem:** How can the instructors track the students' progress while they interact with the LMS 's various features? How can the students be informed of what activities they have already performed in a course?

ii. **Motivation:** In the traditional classroom, instructors watch the students' progress, monitor their various activities, evaluate them and coach them so that they learn as effectively as possible. In the virtual world of LMS, instructors do not have a physical interaction with the students and thus cannot observe them and supervise their learning. For example the instructors do not know whether the students have studied the appropriate learning resources, practiced the on-line exercises, collaborated with their colleagues in their projects, or read the announcements for a course. On the other hand, in large and multifaceted courses, the students do not know which parts of the LMS they have already seen, what remains to be done etc.

iii. **Solution:** Keep records of the students' activities in terms of which parts of the course they have visited and how long they have spent in them, what tools they have used, and maintain files of the conversations that took place in chat rooms, discussion fora etc. Provide the instructor with a tool for observing these records and facilitate him/her in assessing the various activities that students perform, for example by presenting him with statistics about the students' actions. On the students' side, these LMS services can also provide the students with a log of their personal history so that they know where they have already gone and what remains to be seen.

iv. **User category:** Instructors and learners.

v. **Known uses:** WebCT, Blackboard, Intralearn, Saba, FirstClass, Convene and LearningSpace provide tools for tracking the progress of students. On the other hand WebCT, VirtualU, Blackboard, Intralearn, Saba, FirstClass and LearningSpace provide tools for informing students of their own study progress.

vi. **Related Patterns:** E-book delivery, Glossary, Management of on-line questionnaires, Student Assignments Management, Student group management.

Course Initialization

i. **Problem:** How can the administrator of the LMS initialize the courses properly so that they are ready for instructors to customize?
ii. **Motivation:** LMS are complex Web-based systems, usually supporting a large varying number of courses. There is a need for a central maintenance of newly created courses, the proper initialization of technical settings concerning security, performance, physical deployment of the course into the system, the assignment of proper user roles, the integration of previously available information into the new course.
iii. **Solution:** Provide a tool for the creation of a new course to the administrators of the LMS. Provide a set of templates for the new course. After the completion of the setup procedure, accredited course instructors can modify the newly created course according to their needs.
iv. **User category:** Administrator
v. **Known uses:** FLE, BlackBoard and WebCT provide tools to their administrators for the creation of new courses.
vi. **Related Patterns:** Course Creation and Customization, Course backup – restore**.**

Course backup – restore

i. **Problem:** How can the LMS prevent the loss of data after system failure?
ii. **Motivation:** LMS are mission critical systems in the context of educational organizations. They contain valuable information in the form of student data, course and information material. Possible system crashes or other failures can cause the loss of such information, leading the whole learning process in an invalid state.
iii. **Solution:** Make available tools for the backup and restoration of courses to Administrators and encourage them, though the appropriate documentation, to take backups on a regular basis.
iv. **User category:** Administrator
v. **Known uses:** Virtual-U provides both command-line and web-based tools for backup and restore of courses. WebCT, Intralearn and Convene provide a web-based tool for the backup – restore of courses. In addition WebCT suggests the use of separate archiving tools in order to take system-level backups.
vi. **Related Patterns:** Course Initialization.

E-book delivery

i. **Problem:** How can the instructors be provided with an easy and consistent way of creating and structuring electronic course books using hypermedia content?
ii. **Motivation:** No matter what the learning theory and instructional design strategy is adopted by the Instructors or Institutions, the dissemination of learning content in the form of a set of web pages delivered over the web is common in every web-based system facilitating learning processes. The learning content must be structured, have consistent style and layout and provide a uniform and self explanatory user interface metaphors allowing its users (Students) to easily navigate into the hypertext.
iii. **Solution:** Develop a run-time system for the dynamic structure and delivery of the learning content. Provide course Instructors with appropriate tools for structuring the learning content into aggregated logical sets of web pages (i.e. chapters) in a hierarchical manner. These web pages can

be uploaded to the system or created from scratch. Present the content to Students preserving its structure.

iv. **User category:** Instructor**.**

v. **Known uses:** WebCT, Blackboard, VirtualU, COSE, Intralearn, TopClass, LearnLinc, FirstClass, and LearningSpace provide instructors with tools for the creation and management of an electronic book.

vi. **Related Patterns:** Glossary, web page editing, Study toolkit, Searching.

Glossary

i. **Problem:** How can the students be provided with definitions or explanations of terms that appear inside the learning material?

ii. **Motivation:** During the study of a specific topic, certain terms need to be defined or explained. These terms usually appear for the first time, or are of specific importance for the comprehension of a specific learning topic and the achievement of its learning goals.

iii. **Solution:** Develop a mechanism for assigning definitions or explanations to properly inserted terms. The set of these terms constitutes a glossary related to a specific course. This mechanism may support:
   a. An alphabetical index containing the terms of the glossary.
   b. Automatic creation of links to the explanation of the terms appearing in the learning content, wherever possible through a pop-up window.

iv. **User category:** Instructor

v. **Known uses:** WebCT, Blackboard, VirtualU and IntraLearn provide tools for the creation and maintenance of a glossary in courses.

vi. **Related Patterns:** e-book delivery, Searching.

Web page editing

i. **Problem:** How can the hypertext learning content be created or modified in-place?

ii. **Motivation:** Although the learning content integrated into an LMS is usually created by means of specialized development tools, there is a need for adding new web pages or modifying existing ones. These features must be accessible to authorized users (Instructors) over a web-based user interface.

iii. **Solution:** Develop a web-based tool for the creation of web pages or the modification of existing ones. Provide templates or wizards for the creation of new pages and /or an HTML editor.

iv. **User category:** Instructor

v. **Known uses:** WebCT, COSE and FirstClass permit the editing of web pages via a simple web-based HTML editing tool. Zebu provides a web-based user interface for the creation of learning material based on templates and without the need to write HTML code. COSE and FirstClass offer wizards to automate the process of content authoring.

vi. **Related Patterns: e**-book delivery.

Registration-authentication-access control

i. **Problem:** How can all the different users' access rights and privileges be effectively managed?

ii. **Motivation:** LMS are large, multi-user systems accessible via the World Wide Web**.** Due to security, privacy, financial and institutional policy reasons, user access to the resources of on line courses must be restricted to authorized users only. Additionally, user roles vary from guests, granted limited access rights, to administrators with full permissions over the entire system.

Consequently, systems must assign specific rights to the various systems resources according to the role of each user.

iii. **Solution:** Provide a standard registration mechanism for every user of the system. Users may register themselves through a web interface or submit a request for registration to the System Administrator. Every user has a specific role in the system: Student, Instructor and Teaching Assistant. This role may be different for different courses in the same system. Develop a database with user data and provide a mechanism for user authentication.

iv. **User category:** All users

v. **Known uses:** All LMS provide some authentication mechanism and define separate roles of users.

vi. **Related Patterns:** Course grouping, Personalization

Management of on-line questionnaires

i. **Problem:** How can web-based quizzes be created, delivered and graded?

ii. **Motivation:** The administration of on-line tests for the assessment of students is a common task for the majority of LMS. The creation and delivery of questions and tests over the Web is a complicated task due to the interactive, sophisticated nature of the web-based questionnaires.

iii. **Solution:** Provide a mechanism for the creation of on-line questions: closed-end questions with predefined answers, that are able to be automatically graded and open-end questions, that need to be graded by an instructor. Allow the Instructors that create the questions, to be able to allocate a grade to each question. Also give them the ability to announce the schedule of on-line tests so that students are informed in time. Develop a run-time system for the delivery of the tests at the time scheduled, the automatic grading of closed-end questions, the automatic submission of answers to open-end questions to the Instructors and the storage of the results into the students' records. In case of self-assessment questionnaires, assign particular questions to learning units where the student should check the knowledge she/he is supposed to have obtained. The run-time system should make these questions available to the students whenever they access the particular learning units.

iv. **User category:** Instructor, Learner.

v. **Known uses: A**ll LMS that were reviewed have some mechanism for on-line questionnaires.

vi. **Related Patterns:** Assignments management, Student tracking

Student group management

i. **Problem:** How should groups of students be created and managed, and how can projects be assigned to these groups?

ii. **Motivation:** One of the most complicated tasks of both traditional and on-line courses is the management of groups of students. Students must be grouped in working teams, their progress should be tracked during the project time, and ways of communication between the members of the group and the supervising instructor must be established. In addition there must be some repository for the artifacts of the projects assigned to these groups and a mechanism for grading the students.

iii. **Solution:** Provide a tool for the creation of groups of students. The groups can be created either manually, by the instructors, or automatically by the system. The tool should also provide the ability to assign projects to groups, and, optionally, allocate space for the project deliverables, as well as provide a mechanism for the easy upload of these deliverables from group members. The communication between the members of the group should be established through asynchronous (e-mail, discussion forums) or synchronous (chat, video conference) mechanisms. The system should permit the supervisor of each project to participate in the communication sessions between

the members of the groups, to track their progress by reviewing the artifacts of the project and to grade each student at the end of the project.

iv. **User category:** Learner, Instructor.

v. **Known uses:** Blackboard, CoSE, FirstClass, Convene, LearningSpace and WebCT provide tools for the creation and the management of workgroups of students. Gentle WBT has a tool for the definition of working groups, which is available to all types of users.

vi. **Related Patterns:** Student Assignments Management, Asynchronous collaborative learning, Synchronous collaborative learning, Student tracking

Student Assignments Management

i. **Problem:** How to create on-line assignments for students?

ii. **Motivation:** Assigning questions and exercises to students is a common practice for instructors. In the context of a web-based LMS certain matters have to be resolved: How to communicate issues concerning the assignments to students, how to grade students, etc.

iii. **Solution:** Provide a tool for instructors to manage assignments. An instructor can define an assignment adding the following entries: The title of the assignment, a description, links to on-line resources, start and due date. Students are notified for the assignment and prepare their documents for submission. The documents can be sent to the instructor via e-mail.

iv. **User category:** Instructor, Learner.

v. **Known uses:** Virtual-U, WebCT, COSE, Intralearn, Saba, Blackboard, FirstClass, Convene and LearningSpace provide tools for assignments management.

vi. **Related Patterns:** Asynchronous collaborative learning, Synchronous collaborative learning, Announcements, Student tracking. This pattern is also related to the Student Group Management Pattern in the sense that they both facilitate a problem-based instructional approach. The main difference between the two is that while in the former, assignments are disseminated to the whole class and require personal work of each individual student, in the latter, groups are created in order to encourage the collaboration of students along with the supervision of an instructor.

Asynchronous collaborative learning

i. **Problem:** How to allow and facilitate learners and instructors to asynchronously collaborate and interact, to engage learners in problem-solving and critical thinking about issues in a domain, to be able both to mentor and to assess these interactions?

ii. **Motivation:** When students work together they learn from one another and extend their interaction and learning outside of class. Busy schedules and commuting students often make group work difficult to coordinate. When properly applied, technology can eliminate these barriers to collaboration. The main goals for asynchronous collaboration are:

- providing a comfortable setting for contribution by all group members
- enabling convenient collaboration without restrictions of time or place
- archiving learners and instructors exchanges

iii. **Solution:** Asynchronous computer mediated communications (ACMC) can effectively and efficiently support the asynchronous collaborative learning process, due to the fact that they offer flexibility in the use of time as well as space. The most common type of ACMC is the asynchronous text-based communication, such as e-mail, mailing lists, web-based discussion fora.

iv. **User category:** Learners and instructors

v. **Known uses:** All LMS provide both customized e-mail client-servers and discussion fora. Most of them offer tools for creating group mailing lists.

vi. **Related Patterns:** Personalization, Synchronous collaborative learning, Student group management, Student Assignments Management, Announcements, Information distribution Synchronous collaborative learning.

Synchronous collaborative learning

i. **Problem:** How to allow and facilitate learners and instructors to synchronously interact, collaborate and co-operate with peers?
ii. **Motivation:** Synchronous collaborative learning is a computer-mediated effort that simulates face-to-face interaction. Since body language and facial expressions cannot be conveyed through asynchronous communication, real-time communication allows contributions participation, sharing information and social dialogue at a distributed environment. The main advantages of synchronous multimedia communication are:
   - "Next best thing to being present at a lecture hall"
   - Very visual medium; students and teachers can begin to relate to one another.
   - Good for distance education novices for developing a "learning community"
iii. **Solution:** Synchronous multimedia communication tools make it possible for learners and instructors at different sites to partake in the same conference at the same time through the "magic" of two-way audio and two-way compressed video. Examples of types of synchronous communication include:
   - text-based Internet chats
   - instant messaging
   - audio & video conferencing
   - virtual whiteboard applications
   - shared applications
iv. **User category:** Learners and instructors
v. **Known uses:** All LMS provide some sort of chat or conferencing service.
vi. **Related Patterns:** Asynchronous collaborative learning, Student group management, Student Assignments Management

Online support

i. **Problem**: where can LMS users find information about the features of an LMS, solutions to problems about the utilization of the system, the navigation, etc.?
ii. **Motivation**: When an LMS is easy to use, then help is not really needed. However, users need many types of online assistance such as quick reference for achieving a task, (i.e. task-specific help), complete documentation for better understanding of the system, tutorials, etc. Online support should have the following requirements:
   - availability
   - access at any time, at the same time
   - accuracy and completeness
   - correct coverage of the whole system
   - consistency on content, terminology, and style
iii. **Solution**: Online support is provided by LMS either by online documentation, online tutorials and frequently asked questions. It can be categorized as follows: a) quick reference (mostly used as a reminder), task-specific help (for achieving a task), full explanation (for better understanding of the system) and tutorial. In principle, online support/help systems:
   - are hyper-documents
   - allow navigation to topics via auto created contents and index of topics

- save history of shown topics
- support interactive showing

In fewer systems LMS creators adapt the help system to the user. Such "adaptive help systems" are similar to general adaptive user interfaces, monitor user activity (e.g., preferences, mistakes, etc.), and build model of users so that the LMS can actively initiate help.

iv. **User category:** All users

v. **Known uses:** WebCT, VirtualU, Blackboard, Intralearn, TopClass, Learnlinc and LearningSpace provide on-line help to their users. In addition some of them provide "help lines". For example, Ask Dr. C is a question-and-answer service moderated by a dedicated, international community of experienced WebCT users, who accept any question about WebCT.

vii. **Related Patterns:** all the other patterns are related to Online Support since all the tools described by the patterns should be supported by some kind of help.

Information distribution

i. **Problem**: How to allow users to view and share events with other users about education-related events?

ii. **Motivation**: Users need mechanisms that can provide either private or public (centralized) access to current and past information about instructional events, meetings, etc. Such mechanisms should be used for:

- Planning future events (e.g. mid-tem examination)
- Checking dates when planning events to avoid scheduling conflicts (e.g. attendance at a meeting)
- Checking the archive of events
- Searching for types of events using keywords or text matches

iii. **Solution:** Some LMS incorporate calendar systems that hold a number of features, enabling the user to publish events and customize the calendar according to his/her needs and preferences. Such features are:

- View calendar in Day/Week/Month view
- Navigation: go to today; go to specific date; go to next Day/Week/Month
- Add/Edit/Delete Events
- Date and Time picker components
- Repeating events
- User-defined categories for events
- Search for events by title and description
- Event alarms; notification on desktop, email, or text pager
- Send event invitation by email

iv. **User category:** Instructor, Learner.

v. **Known uses:** Blackboard, WebCT, VirtualU, Intralearn, Convene and LearningSpace have a calendar tool that enables either private or public event announcements, which can be linked to their personalization services.

vi. **Related Patterns:** Personalisation**,** Asynchronous collaboration learning, Announcements.

Conclusions and future work

This paper has attempted to initiate the establishment of a pattern language for Learning Management Systems. We believe that such a pattern language can have the following advantages for designers of Learning Management Systems:

- Reduced time and cost of designing and developing LMS.
- Increased software qualities of LMS and especially in the usability sector.

- Increased pedagogical quality of LMS and especially learning effectiveness.

Future work is concerned with establishing an initiative for constructing a repository of design patterns for Learning Management Systems in order to attract more researchers into depositing their own patterns. That would strengthen the pattern language and offer a wealthy pool of patterns, so that inexperienced designers of LMS could base their work on a sound and systematic basis. Furthermore, an experimental LMS is already being constructed that incorporates the patterns proposed in this paper. The aim is to illustrate the actual implementation of these patterns by showing the implementation details and offering a complete description of the patterns using a GOF-like description template. Finally we intent to expand the application domain of patterns to the general context of e-learning that will include the design of web-based learning content, as well as the organization of the human actors that participate in such systems. That would result in a holistic approach of documenting the design expertise of instructional design in web-based instructional systems by capturing all of their subsystems.

References

1. Alexander, C. , Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I. and Angel, S. (1977). *A Pattern Language*. Oxford University Press, New York.
2. Alur, D., Crupi, J. and Malks, D. (2001). *Core J2EE Patterns: Best Practices and Design Strategies.* Prentice Hall.
3. Borchers, J. (2001). *A pattern approach to interaction design.* John Wiley.
4. Brown, W., Malveau, R., McCormick, H., Mowbray, T. (1998). *AntiPatterns: Refactoring Software, Architectures, and Projects in Crisis.* John Wiley & Sons.
5. Buschmann F., Meunier, R., Rohnert, H., Sommertland P. and Stal, M. (1996). *Pattern-Oriented Software Architecture, Volume 1: A System of Patterns.* John Wiley & Sons.
6. Carlson, P. (1998). Advanced Educational Technologies – Promise and Puzzlement, *Journal of Universal Computer Science (JUCS)*, (Special Issue), 4(3).
7. Cooper, J. (2000). *Java Design Patterns.* Addison-Wesley.
8. Eriksson, H. and Penker, M. (2000). Business Modelling with UML, Business Patterns at work, John Wiley & Sons.
9. Fowler, M. (1996). *Analysis Patterns: Reusable Object Models*, Addison-Wesley.
10. Gamma, E., Helm, R., Johnson, R. and Vlissides, J. (1994). Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley.
11. Garrido, A., Rossi, G. and Schwabe, D. (1997). Pattern Systems for Hypermedia. In Proc. of *PLOP'97* - University of Illinois, Monticello, USA.
12. Garzotto, F., Paolini, P., Bolchini, D. and Valenti, S. (1999). Modeling-by-Patterns of Web Applications", In Proc. *International Workshop on the World Wide Web and Conceptual Modeling*, WWW CM'99, Paris, November 1999.
13. HCI design patterns web site http://www.hcipatterns.org/
14. Hypermedia Design Patterns Repository, http://www.designpattern.lu.unisi.ch/HypermediaHomePage.htm
15. IEEE Learning Technology Standards Committee (LTSC). (2001a). *Draft Standard for Learning Technology Systems Architecture (LTSA)*, Draft 9, http://ltsc.ieee.org/.
16. IEEE Learning Technology Standards Committee (LTSC). (2001b). *Draft Standard for Learning Object Metadata (LOM)*, Draft 6.4, http://ltsc.ieee.org/.
17. Lyardet, F., Rossi, G. and Schwabe, D. (1998). Using Design Patterns in Educational Multimedia Applications. In Proc. *EDMedia'98*, Freiburg, Germany.
18. Lyardet, F., Rossi, G. and Schwabe, D. (1999). Patterns for Adding Search Capabilities to Web Information Systems. In Proc. of *Europlop'99*, pp. 134-147, Kloster Irsee, Germany, IEEE Press.
19. McCormack, C. & Jones, J. D. (1997). *Building a Web-based Education System*, Wiley Computer Publishing.

20. Moore, M. G., & Kearsley, G. (1996). *Distance Education: A Systems View*, Wadsworth Publishing Company.
21. Nanard, M., Nanard, J. and Kahn, P. (1998). Pushing reuse in hypermedia design: golden rules, design patterns and constructive templates. In Proc. of *Hypertext'98*, Pittsburgh, Pennsylvania, USA.
22. Pedagogical Patterns Project site, http://www.pedagogicalpatterns.org/.
23. Rossi, G., Garrido, A. and Carvalho, S. (1996). Design Pattern for Object-Oriented Hypermedia Applications". In Vlissides, J., Coplien, J., Kerth, N. (Eds.) *Pattern Languages of Program Design, Vol. 2*, chapter 11, pp. 177-191., Addison-Wesley, 1996.
24. Rossi, G., Schwabe, D., and Garrido, A. (1997). Design Reuse in Hypermedia Application Development. In Proc. of *Hypertext'97,* Southampton, UK.
25. Rossi, G., Lyardet, F. and Schwabe, D. (1999). Patterns for designing navigable spaces. In Harrison, N., Foote. B. and Rohnert, H. (Eds.) *Pattern Languages of Programs 4*, Addison Wesley.
26. Schmidt, D., Stal, M., Rohnert, H., and Buschmann, F. (2000). *Pattern-Oriented Software Architecture, Volume 2: Patterns for Concurrent and Networked Objects.* John Wiley & Sons.

Position paper 'Lifelong Learning' (SIG 2)

Ellen Rusman, Educational Technologist of Open University of the Netherlands

Introduction

'Lifelong learning'- a phrase which is heard and used in many different contexts. Dependent on the perspective – economic, politic, philosophical, social-cultural or educational- it has different definitions and meanings and is often used as a container concept. As Smith (2001) [6] states, the vagueness of the notion and its capacity to be used to serve very different, political ends, has opened it up to considerable critique. But, within all these definitions the initial, central idea, articulated by Lindeman as well as Yeaxlee at the end of the 20-ties of this century, based on the French notion of 'education permanente' and developments in adult education in Britain and North America, is alive : 'It is not only that education carries on throughout life, it is also part of living'.

Yeaxlee elaborates this concept in his book 'Lifelong education' of 1929 in which he argues for a 'much wider and fuller lifelong education'. He states: (adult) 'education is as inseparable from normal living as food and physical exercise. Life, to be vivid, strong, and creative, demands constant reflection upon experience, so that action may be guided by wisdom and service be the other aspect of self expression, while work and leisure are blended in perfect exercise of 'body, mind and spirit, personality attaining completion in society'. Much (adult) education will never know itself as such and will be recognized only by leaders and teachers of real insight. It will go on in clubs, churches, cinemas, theatres, concert rooms, trade unions, political societies and in the homes of the people where there are books, newspapers, music, wireless sets, workshops, gardens and groups of friends'.

This concept, if accepted and implemented, can have significant impact on existing structures in society. Tight (1996)[7] identifies three key features out of subsequent accounts of lifelong education: First, lifelong education is seen as **building upon and affecting all existing educational providers**, including both schools and institutions of higher education… Second, it extends beyond the formal educational providers to **encompass all agencies, groups and individual involved in any kind of learning activity**.. Third, it rests on the belief that **individuals are, or can become, self-directing**, and that they will see the value in engaging in lifelong education.

These ideas are further elaborated in many political documents[8] which are steering and guiding the educational field nowadays and are effecting current and future society and educational organisations.

Objectives of SIG

The objectives of our SIG, as derived from the E-LEN project plan and the planning of WP3 are to:

- describe practical solved and unsolved problems in the field of lifelong learning (LLL)
- share knowledge and experience within the field of LLL (knowledge sources, contact, relevant organisations)
- define patterns in field of LLL based on shared problems, knowledge and experience

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[6] Smith, M.K. (1996, 2001) 'Lifelong learning', *the encyclopaedia of informal education,* http://www.infed.org/lifelonglearning/b-life.htm , Last updated: September 22, 2002

[7] Tight, M. (1996). *Key concepts in Adult Education and Training*. London: Routledge.

[8] http://www.eurydice.org/Doc_intermediaires/analysis/en/lifelong_learning.html, http://www.resource.gov.uk/action/learnacc/muslearn/lllearn.asp, http://europa.eu.int/comm/education/life/, http://www2.trainingvillage.gr/etv/lll/index.asp

Proposed SIG-rules

As a moderator I would like to propose some working rules with the aim to get our SIG started and to keep it 'alive and kicking'. I would like to ask you the following as a participant:

1. If you post your first message and/or you are a new member of the group, please give a short introduction to yourself. You may use anything to help to get the others a lively idea of the 'person behind the computer' (including photo's, websites, hobbies etc.) and to describe you affinity with the topic of LLL. Please do not exceed an A4.
2. Check the contents of the discussion group at least every two days, so the discussion doesn't 'die'. If you won't be able to check the discussion for a while, e.g. due to a holiday, announce this within the group or try to arrange a replacement by a colleague.
3. While participating in the group always keep the objectives of the group in your mind, don't post just anything you find on the subject of LLL, but always try to connect it to an ongoing discussion and/or chosen topics. This will protect us from a general information overload.
4. …… any alterations, suggestions and additions on the above proposed working rules are very welcome!…..

Some questions to start with…

To come to some suitable and relevant topics for our SIG within the field of LLL I would like to ask you to think some of the following questions over and post your ideas/examples before 20 th of May in the discussion group of POLARIS.

- What influence has the before mentioned concept of Lifelong learning (LLL) on your daily educational practice and within your organisation? What are the initiatives which have been started or are just beginning in your context/surroundings?
- What are, according to you, topics which should be elaborated on within our SIG? Why are they relevant for you, your organisation and/or other organisations?

Please illustrate your postings with examples out of daily practice, when it's possible/easy to realize and interesting for the other participants and don't forget to introduce yourself !!

Towards a pattern language for e-learning: a discussion paper (SIG 3)

Peter Goodyear, CSALT, Lancaster University, May 2003

Purpose and structure of this paper

This discussion paper has two main purposes, within the context of the E-LEN project and especially the work on design patterns to be facilitated by the E-LEN CSCL SIG. First, it is intended to provoke some discussion – mainly about the nature and value of design patterns but also about the best ways for us to proceed. To help with this discursive goal, I have made this quite a personal paper. I haven't struggled too hard to take on the appearance of objectivity. The second aim is just a little more convergent – it is concerned with pushing us forward a bit with the actual work of producing some design patterns (for CSCL). I don't intend to go too far down this route, since I don't intend to go down it entirely on my own. In the work of the SIG, it seems to me, we need a clever interleaving of periods of convergence and debate.

In the 'next steps?' section at the end of the paper, you will find some initial thoughts of mine about what we should try to do next.

The structure of the paper is quite simple. I will offer a few thoughts about the domain of CSCL and then about the nature of contemporary educational design. The main part of the paper is my attempt to explain what I find attractive about the notion of trying to apply Christopher Alexander's ideas about design patterns and a design language to educational design and CSCL. This main section focuses on the following features of Alexander's approach: the way patterns are both empirical and normative; the internal structure of patterns; the external relationships between patterns, and way the use of patterns is embedded in a set of democratic or vernacular values.

I then try to relate the use of patterns to some conceptual distinctions I drew in some work which attempted to find informative parallels between architecture and educational design practices (see Goodyear, 1999; 2000). This includes some consideration of what is legitimate for educational designers to try to create/manage and what should be left free for the learner.

Finally, I try to formulate some reservations I have about when it might not be appropriate to try using a pattern-based approach and I conclude with some suggested discussion points.

CSCL

There is a very large literature on collaborative, cooperative and group learning: much of it reporting research on children's learning, but some of it with a close connection to the higher educational (and related) settings in which we are mainly interested in E-LEN. Within the field of CSCL there have been regular discussions about the nature and boundaries of the domain – indeed I may have missed some in an earlier stage in the E-LEN project. (If so, I apologise and invite someone to provide the E-LEN 'take' on CSCL.)

Many people use the terms 'collaborative' and 'cooperative' interchangeably.

According to McConnell (1994) 'In the very broadest sense, cooperative learning involves working together on some task or issue in a way that promotes individual learning through processes of collaboration in groups' (p15). Cooperative learning allows each individual to gain by drawing on the diverse resources of the group. McConnell claims that cooperative learning can give rise to valuable outcomes which have not (until recently) been much in evidence in academic learning: increased competence in working with others, self-assurance, etc. McConnell also values the way in which making one's learning public can give one a better understanding of it (pp.16-17). Sharan (1990) agrees - cooperative learning can give one a better understanding of the learning process.

McConnell (pp.20-23) contrasts two views of cooperative learning:

the curriculum centered and externally motivated approach which is, he claims, gaining currency in US HE, and which has been widely researched by Slavin (1990) and others,

the learner/issue-centered and learner motivated approach characteristic of some traditions in UK adult education.

Distinguishing between cooperative and collaborative learning

Some authors help us find potentially useful differences between cooperationa nd collaboration. For example, Roschelle and Teasley (1995) say that cooperative work

'…is accomplished by the division of labor among participants, as an activity where each person is responsible for a portion of the problem solving…', whereas collaboration involves the '…mutual engagement of participants in a coordinated effort to solve the problem together.'

Dillenbourg et al. (1996) point out that

'cooperation and collaboration do not differ in terms of whether or not the task is distributed, but by virtue of the way in which it is divided: in cooperation, the task is split (hierarchically) into independent subtasks; in collaboration, cognitive processes may be (heterarchically) divided into intertwined layers.'

In the discussion-oriented contexts which are still the dominant form within many e-learning/networked learning/CSCL programmes, this distinction between co-operation and collaboration can be quite a tricky one. For example, it is not at all clear that there is a single learning task to be subdivided. It is more likely that multiple agendas and multiple tasks are in action, over what may be quite a prolonged period. What is important, however, is to be clear about the nature of the tasks set and about their implications for collaboration or cooperation. In turn, this requires reflection on the kinds of learning activity and outcome which are likely to be associated with collaboration and cooperation respectively. [I'm off track already…maybe we should just *assert* our working definition of CSCL. Suggestions?]

The need for educational design

The discipline of educational design is struggling to find methods of dealing with complexity. More comprehensive and subtle conceptions of learning, and the diversifying affordances of new technology, create design problems which cannot be solved by the methods of instructional design that prevailed through the 1960s-80s. Compounding the problem, the so-called 'constructivist revolution' among North American instructional designers during the late 80s/early 90s took attention away from the fact that more complex conceptions of learning need *richer* methods of educational design, not the abandonment of design altogether (see e.g. Duffy & Jonassen, 1992).

In the last few years we have seen renewal of interest in systematic approaches to educational design, and some of this work gives proper regard to the complexity of learning. Van Merrienboer's 4C-ID methodology, which is aimed at designing tasks for the acquisition of complex skills, would be one good example (see e.g. van Merrienboer, 1997). However, I think this work on the design of good learning *tasks* tackles only one of the three main parts of the educational designer's problem space. Figure 1 helps explain what I mean.

Educational design problem space (Goodyear, 2000)

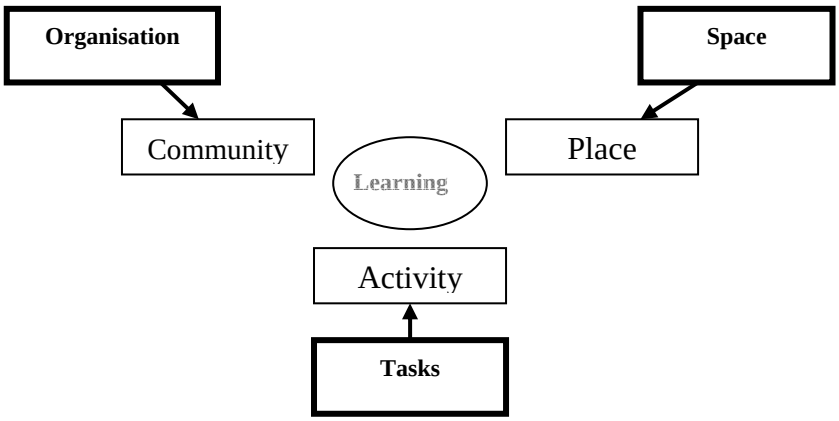


Figure 1 says that task design is not enough. The physically and socially situated character of learning means that educational design also needs to work on the physical setting within which learning 'takes place' and on those aspects of social organisation which can have beneficial effects on learning, notably through creating the conditions in which a learning community can thrive. Educational design therefore has (at least) three main components: task design, the design of convivial learning spaces and the design of organisational forms which are conducive to learning as a social process.

An implicit claim in Figure 1 is that we should not try to design the elements which are most closely involved in learning itself. There needs to be some possibility for the learners themselves to adapt and reconfigure what we create. Thus, it is appropriate for us to try to design organisational forms, learning spaces (the physical learning environment, including all the artefacts which embody 'content') and learning tasks. But we should expect students to customise our learning spaces and make their own 'local habitations' or 'nests' (Nardi & O'Day, 1999; Crook & Light, 1999; Crook 2002). We know that their *activity* will be (at best?) a satisficing response to the tasks we design for them. And we should be very wary of the notion that we can 'create' communities. We should, perhaps, stick to the familiar territory of creating and managing organisational forms, in the confident hope that these will nurture the kinds of learning community which we value.
On this account, design patterns for CSCL ought to help us with more than tasks – they should also help with the design of space (how apt!) and the design of convivial organisational forms too. At least, I think that may be true, but I'd welcome arguments for and against.

The intuitive (?) appeal of Alexander's patterns

I think it's important to acknowledge that the recent work on pedagogical patterns has not drawn directly on Alexander's architectural work of the 1970s. Rather, areas of software engineering have acted as a mediating domain. Most of what I have read on the web about pedagogical patterns comes from people who have been involved in creating patterns for software objects and have then begun to think about how they might develop pedagogical patterns appropriate to their teaching (e.g. in courses on object-oriented software engineering).

I'm going back to the source and in particular to Alexander et al (1977).

Each of the next four subsections is a first attempt to distil what I find intuitively appealing about the approach and especially its potential for educational design.

Before that, a reminder of what Alexander had to say in introducing his main ideas.

Christopher Alexander on design patterns and pattern languages

1. The elements of a pattern language are the entities called patterns. Each 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.' (ibid., p.x).
2. The relationships between patterns are very important. Higher level patterns, as well as patterns on the same level, provide the context for a lower level pattern. Lower level patterns complete and embellish higher level patterns.
3. This implies that patterns are ordered. For Alexander, this ordering is largely determined by scale (from region, to town, to neighbourhood, to building to details of the building). [We need to find at least one equivalent of this sense of physical scale, that works in education/learning. We should not assume that a scale based on the perspective of educational providers is the only or the best way to do this – degree programme, course module, lesson, learning event, for example.]
4. The relationship between patterns can be thought of as a network. However, the use of a pattern to work on a problem of building must be thought of as a sequence – a journey through parts of the network. NB Alexander et al. are happy to talk about these smaller sequences (such as the ten patterns applicable to building a porch) as themselves constituting a pattern language – thus he offers an example of a pattern language for a porch (ibid., pxxxv.)
5. The internal structure of a pattern is also distinctive. I won't go into the presentational details here – though these are important aids to browsing and understanding the patterns. Patterns bring together problem definitions and solutions. Solutions are not narrowly prescriptive. Rather, they provide '…the essential field of relationships needed to solve the problem, but in a very general and abstract way-so that you can solve the problem for yourself, in your own way, by adapting it to your preferences, and the local conditions at the place where you are making it' (ibid, p.xiii). What's important here is a sense of the essence of a problem solution – an 'invariant' and more variable parts in a solution. Alexander uses this notion of finding invariance in solutions as a way of discriminating between less well worked out and more thoroughly worked out patterns. The patterns he published are marked with asterisks – two if he believes they have found some true invariants in their pattern – 'that the solution we have stated summarises a *property* common to *all possible ways* of solving the stated problem.' (ibid, p.xiv, original emphasis). Where they have made less progress with a pattern, (where there may be other ways of finding a solution), they use one or no asterisks to denote this fact, and the fact that the reader is free to improvise upon what they have found. Patterns are meant to be 'alive and evolving' (pxv) – each can be regarded as a hypothesis '…our current best guess as to what arrangement of the physical environment will work to solve the problem presented' (p.xv). Empirical questions can then be raised with respect to both the problem (does it occur? does it feel as we have described it?) and the solution (does it resolve the problem?). The asterisks represent Alexander's faith in the hypotheses. [We could develop some interesting side links here to the Popper-inspired work of Carl Bereiter on learning and the co-construction of conceptual artefacts, such as hypotheses – see Bereiter, 2002.]
6. The pattern language published in Alexander et al (1977) was the result of eight years work by a substantial team. This work involved *both* an attempt to understand the nature of the building process (very broadly defined) *and* to construct an actual possible pattern language. The observational/empirical aspects of the work are important. Although many variations in patterns are possible, and it's difficult to see how rapidly patterns might change in the future, Alexander claims that some patterns are 'archetypal' – 'so deeply rooted in the nature of things, that it seems likely they will be a part of human nature, and human action, as much in five hundred years as they are today' (p.xvii)

7. A rationale for the approach is that unless people share a common pattern language (with respect to towns and buildings) then their towns and buildings will not 'come alive'. All members of a society need to be able to participate in the making of buildings (one way or another). The book(s) are seen as a first step in a social process in which people become conscious of their own pattern languages, and set out to improve them. '..the languages that people have today are so brutal, and so fragmented, that most people no longer have any language to speak of at all-and what they do have is not based on human, or natural considerations.'(ibid, p.xvi). [This resonates with educational research literature which shows how many teachers, especially in higher education(?), are very inarticulate about learning and teaching (e.g. Dunkin, 2000).]
8. Pattern languages are better if you write poetry with them than if you write prose. This relates to the multiple meanings carried by words and phrases in a poem (as compared with a book of instructions, for example). Good patterns and good building designs have density and profundity. One should try to compress a design into a few patterns.

Now I turn to my sketch of what I find attractive about Alexander's work, when considered from the perspective of educational design.

Virtue 1: patterns are both empirical and normative (but not prescriptive)

This is an aspect of the approach which isn't obvious from the object-oriented software engineering or pedagogical literature on patterns – or if it is, I've missed it. Patterns, in Alexander's work, capture both (i) patterns which recur in the built environment and (ii) design guidance. That is, they are abstractions based on empirical observation of recurring phenomena in the built environment but they are also normative – the text of pattern descriptions is meant to help you act in a certain way – whether modifying part of your house, designing a building, taking action against plans for changes in your neighbourhood or discussing plans for regional development. In contrast, the pedagogical patterns I have looked at have been normative only – they are designs or prescriptions or suggestions.

The empirical aspect raises an important question. What does it make sense to look for? While we mustn't be captured by the discourse of architecture and town planning, nor become obsessed with solid artefacts, the idea of observability entails (i) that what we are looking for has the capacity to manifest itself to our senses and (ii) that it has some persistence.

In the context of CSCL, this reminded me of Morten Paulsen's famous pedagogical techniques (Paulsen, 1995). Paulsen, you may recall, provided a catalogue or taxonomy of pedagogical techniques which had been tried out in the practice of online teaching and reported in the literature. Example techniques are shown in Figure 2.

Framework of Pedagogical CMC Techniques (after Paulsen)

One-alone Techniques
On-line databases On-line journals On-line applications Software libraries On-line interest groups Interviews

One-to-one Techniques
Learning contracts Apprenticeships Internships Correspondence Studies

One-to-many Techniques
Lectures Symposiums Skits

Many-to-many Techniques
Discussion groups Debates Simulations or games Role Plays Case studies Transcript based assignments Brainstorming Delphi Techniques Nominal group techniques Forums Project groups

This raises the question – what kinds of artefacts or phenomena should we be looking for – in the context of CSCL – when we want to capture patterns which are empirically-based?

Virtue 2: patterns have an internal structure which is good for action-oriented evidence-based advice

I sketched Alexander's 'formalism' or template for writing a pattern, above, This is described in more detail in pp.x-xi of Alexander et al (1977) and of course there are the 253 patterns which make up the body of the book.

I think the combination of problem description and 'solution' is powerful, if one gets the level of abstraction right. The problem must be recognisable but not too specialised. The solution must be sound, contain useful guidance but not prescribe fine details. I'm not sure we could deal with 253 patterns for CSCL (and it will take longer than we have in E-LEN to produce them). Abstraction helps manage the complexity here. What's also good about the way Alexander formats his patterns is that there is a 'slot' for an account of the issues at stake – which can refer to research literature but can also draw on rational

analysis, social values, aesthetics, etc. For example, his pattern 'Corner Grocery' (p. 440-443) includes almost two pages of text arguing why corner groceries are important for the health of a neighborhood. Reference is made to some studies of people's perceptions of their neighbourhood and to small scale empirical studies (interviews to find out how far people are prepared to walk to do their shopping) carried out by Alexander's team. This is a nice example of how small-scale research can inform the analysis of a problem, without having to make grand claims about educational theory.

Virtue 3: there is expressive and normative power in the relations between patterns

Guidelines in educational design tend to run into problems of scope and scale, though some examples can be found of texts which try to lead you through a series of decisions at macro, meso and micro-scales. (Some of Romiszowksi's work – e.g. his 1981 book – was of this kind.) The network nature of Alexander's pattern language helps with this problem, I think. For instance, the idea of a pattern serving to embellish higher-level patterns, *and* work alongside patterns of the same scale level, *and* provide a context for lower-level patterns gives us some real power in (i) expressing educational ideas/problems/issues and (ii) in formulating comprehensible guidance.

Virtue 4: the pattern-based approach is inherently democratic/inclusive

Alexander's patterns are suffused with the language of political action and democratic/popular involvement in the processes of town planning and architecture. Staying with the 'corner grocery' example – he says we should act to ensure the continuing existence of small corner grocery stores by passing laws which restrict franchising and the emergence of multi-store chains.

I find two sets of resonances (with our work in education) quite powerful here. The first is with some recent work we did (guided by Viv Hodgson) in producing the 'E-Learning Manifesto'. This was published at the Networked Learning Conference in 2002 and was a statement by a group of CSCL practitioner-researchers about what we saw/see as valuable in E-learning: what's worth fighting for and what should be resisted. It seems to me that patterns can (and probably should) be used to express educational values.

Secondly, the Manifesto was the work of teachers. Alexander's message ought to extend to learners. Patterns and pattern language ought to be produced and made accessible in a way which allows learners to use the ideas in configuring their own learning environments. It has natural sympathies with ideas in open learning – with learners taking more control and more responsibility for their own learning. It also approaches this in a *social* way. Alexander is more concerned with empowering groups than with liberating the consumer. This is a nice counterweight to the very powerful messages that we sometime get from government or the e-learning industry about the value of individualised, on-demand, commodified learning.

Alexander's point about the 'brutal' nature of language works for me here. In trying to help (and evaluate) the activity of multidisciplinary teams who are trying to create resources and services for e-learning in different UK universities, I've been struck by the impoverished nature of the language available to the members of the teams and the way this restricts them to thinking about educational processes in a very rudimentary way. It's hard to get beyond transmissive models of learning/teaching when you have phrases ready to hand like 'getting the information across' and when anything which tries to capture ideas about active engagement in the co-construction of knowledge sounds like empty peda-babble. A point to argue about might be whether patterns can help technologists and subject-matter experts (in universities or elsewhere) appropriate language and concepts which are fit for learning in the 21st century.

Patterns and the problem-space of educational design

Fig 1 offers a way of thinking about the components of the educational designers task: space, tasks and organisational forms. Is each of these a fit territory for finding/developing patterns and a pattern language? Or should a pattern language for CSCL be more unified – a single language rather than three? Or does it make much more sense to try to work out patterns for (say) the space:place component rather than the organisation:community component or the task:activity component?

Since I'm not sure about this, I offer it up as a topic for discussion! (I'd be happy to say more, but had better get this paper finished.)

Reservations about patterns (or the use of patterns?)

I've read some pedagogical patterns literature which leaves me wondering whether the authors have missed the point. What they end up doing is offering guidance about how to do something – like run a seminar – but in a way which doesn't (to me) seem to gain much leverage from Alexander's ideas. (I'll add some examples later.)

Rather than fret too much about problems with patterns just now, my instinct is to say that in producing some patterns we'd do well to keep our collective metacognitive processes at work – let's keep an eye on what we are doing in producing some patterns (hard enough in itself) to try to develop some kind of sensibility or intuition about the strengths/weaknesses/limitations of the patterns approach. We need to get a sense of what they are especially good for, as well as a sense of what to use when patterns don't feel like the right approach.

Suggested discussion points

1. Does my three component model (Fig 1) make a reasonable starting point for thinking about a high level structure for the production of patterns? I don't know. If it doesn't, how else might we structure the problem space of educational design for CSCL? Or should we work bottom up and hope that structures and order will emerge?
2. How much should we try to learn from Alexander? Am I being too subservient to the master? Should our point of departure be instead some of the work on patterns in pedagogy or software engineering?
3. What makes a sensible equivalent to Alexander's idea of scale? He works from region to town to neighbourhood to street, etc. Should we work from programme to module to lesson to learning event? Or from university system to university to faculty to department to staff member? If we think about the learner's perspective, what is 'near' and what is 'far' – what is macro and what is micro?

Next steps

As well as discussing some of these issues (and any others you want to raise) we also need to make some progress on pattern finding/drafting. I don't think this is a contradiction. I don't think we have the time to discuss and discuss until we reach some consensus on the high level issues, prior to getting our hands dirty with some pattern writing. We probably have to do both of these things, pretty much together – bottom up as well as top down.

So, my next step will be to try writing a couple of patterns arising from some of my experience as a teacher in the 'e-learning/networked-learning' field. I don't know what they will be. Nor do I know what your next step should be, till you tell me.

References

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

Bereiter, C. (2002). *Education and mind in the knowledge age*. Mahwah NJ: Lawrence Erlbaum Associates.

Crook, C. (2002). The campus experience of networked learning. In C. Steeples & C. Jones (Eds.), *Networked learning: perspectives and issues* (pp. 293-308). London: Springer.

Crook, C., & Light, P. (1999). Information technology and the culture of student learning. In J. Bliss, R. Saljo, & P. Light (Eds.), *Learning sites: social and technological resources for learning* (pp. 183-193). Oxford: Pergamon.

Dillenbourg, P., Baker, M., Blaye, A. and O'Malley, C. (1996) The evolution of research on collaborative learning *In* Reiman, P. and Hans, S. *Learning in humans and machines: towards an interdisciplinary learning science* Elsevier Science Ltd, Oxford
Duffy, T., & Jonassen, D. (Eds.). (1992). *Constructivism and the technology of instruction: a conversation*. Hillsdale NJ: Lawrence Erlbaum Associates.
Dunkin, M. (2000). Novice and award winning teachers' concepts and beliefs about teaching in higher education. In N. Hativa & P. Goodyear (Eds.), *Teacher thinking, knowledge and beliefs in higher education* . Dordrecht: Kluwer.
Goodyear, P. (1999). Educational technology, virtual learning environments and architectural practice. In D. Ely, L. Odenthal, & T. Plomp (Eds.), *Educational science and technology: perspectives for the future* (pp. 74-91). Enschede: Twente University Press.
Goodyear, P. (2000). Environments for lifelong learning: ergonomics, architecture and educational design. In J. M. Spector & T. Anderson (Eds.), *Integrated and Holistic Perspectives on Learning, Instruction & Technology: Understanding Complexity* (pp. 1-18). Dordrecht: Kluwer Academic Publishers.
McConnell, D. (1994). *Implementing computer supported cooperative learning*. London: Kogan Page. [there is of course a 2nd edition of this book, published in 2000, but these page references are to the 1994 edition, the only one I have to hand]
Nardi, B., & O'Day, V. (1999). *Information ecologies: using technology with heart*. Cambridge Mass: MIT Press.
Paulsen, M. (1995). *The on-line report on pedagogical techniques for computer-mediated communication*. Available: http://www.nki.no/~morten.
Romiszowski, A. (1981). *Designing instructional systems*. London: Kogan Page.
Roschelle, J. and Teasley, S. (1995) The construction of shared knowledge in collaborative problem solving *In* O'Malley, C. E. (Ed.) *Computer-supported collaborative learning* Springer-Verlag, Heidelberg.
Sharan, S. Ed (1990) *Cooperative learning: theory and research*, Praeger, New York
van Merrienboer, J. (1997). *Training complex cognitive skills: a four component instructional design model for technical training*. Englewood Cliffs, NJ: Educational Technology Publications.
Wisner, A. (1995). Situated cognition and action: implications for ergonomic work analysis and anthropotechnology. *Ergonomics, 38*(8), 1542-57.

Time for Reusability of design strategies on Adaptive Learning (SIG 4)

Simeon Retalis, University of Cyprus

1. Scope

Educational applications suffer from certain problems that reduce the anticipated benefits from these applications in the learning process. Such problems are:

- The lack of a teacher-mentor who would guide the user/learner during the learning process.
- The absence of concern about the individual characteristics of the users/learners, their previous knowledge about the subject they are studying, their history in accessing the learning content, their learning style, their preferences, etc.
- Especially in hypermedia, the lost in hyperspace problem, where a user/learner looses his orientation when navigating into a complicate hypertext structure.

Adaptive learning systems come to address these problems and to provide individualized and personalized presentation of educational content, easing the user's access in the content and facilitating the learning process [Bra & Calvi 2000, Brusilovsky 96].
A number of existing adaptive learning systems have been developed (such as Intelligent Tutoring Systems, Adaptive Hypermedia Educational Systems, Adaptive Testing Systems), each one having its own adaptation approach and implementation strategy [Brusilovsky 98].
As an attempt to capture the common elements of these strategies, to provide a better understanding of their various aspects and to facilitate the design and integration of adaptive learning features into systems, there is a need for identification of *design patterns* in this area.
Design patterns will be developed so that adaptive learning systems will not be designed and implemented from scratch, but based on reusable design experience gained over several years of try-and-error attempts.

2. Rationale

Experienced designers know how to solve certain problems because they have seen them appearing repeatedly and have developed design patterns implicitly in their head. These implicit design patterns are in practice what separates the experienced designer from the novice one. According to [Alexander et al. 77]: "each 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".
Patterns are not conceived in a big bang but rather discovered or mined after numerous implementations of the same solution in a given problem, usually by different people. It is more or less a process of reverse-engineering the systems that embed good design in order to make that design explicit, and be able to communicate it to other designers, so that it becomes common practice.
The history of patterns and their proliferation is well known and broadly documented. It all began in the field of building architecture, when Christopher Alexander invented the idea of capturing design guidelines in the form of design patterns [Alexander 77]. The 'Alexandrian' patterns found many followers in the computer science discipline, especially after the so-called 'GOF' book for object-oriented design [Gamma et al 94]. In specific the fields that adopted patterns were: software architecture [Buschmann et al. 96, Schmidt et al. 00], hypermedia engineering [Rossi et al. 96a], Human-Computer Interaction [Borchers 01], etc.
This paper aims to move research steps towards that direction by proposing an initial set of design patterns for Adaptive Learning. The patterns that will be gathered via collaboration of specialists in this area are meant to work synergistically and when implemented to become part of Adaptive Leaning Systems.
The intention of this SIG for forming adaptive learning patterns is to capture design expertise, implementation experience and present it in a comprehensible and usable format. In this way, designers of new or existing learning systems, especially inexperienced designers can take advantage of previous design expertise and save precious time and resources in incorporating adaptive learning strategies.

3. Actions

In order to address the need to create adaptive learning patterns a series of steps should be made:

- To reach to a common understanding about terminology in adaptive learning. For example, a glossary of terms and concepts such as adaptivity, adaptability, user modeling will be created.

- To identify the main problems that adaptive learning tries to solve and document the strategies used as solutions. Such problems are: user modeling, content sequencing, assessment, content presentation style, etc.
- To decide the appropriate format for presenting and documenting the solutions as design patterns. As eloquently stated in [Gamma et al. 94], it is more difficult to describe patterns than to actually find them. Almost every one of those who have proposed patterns in a subject field, has also suggested a novel way of describing and cataloging them. Our suggestion for a pattern description format is a variation of the Alexandrian template that contains the following fields:
    i. **Name** – a unique name to distinguish the pattern and uniquely refer to it.
    ii. **Problem** – a brief description of the design problem at hand.
    iii. **Motivation** – an explanation of the origins of the problem, probably with an example for better communicating it. It may also contain the context of the particular problem if it is necessary in order to make it more comprehensible.
    iv. **Solution** – a description of the solution proposed by this pattern that addresses the problem and motivation stated earlier.
    v. **User category** –learning actors (learners, instructors, tutors, system, etc.)
    vi. **Known uses** – examples of the pattern in real adaptive learning systems. This is an important attribute of a pattern since it is claimed that a proposed pattern gets accepted by the corresponding pattern community, only if there have been identified two or three examples of its use by someone other than the one who suggested the pattern.
    vii. **Related Patterns** – other patterns that are related to this one in some way. It is noted that the patterns proposed in this paper, except for being related to each other, are also related to hypermedia design patterns.

4. Epilogue

In this SIG we will try to reveal and document in a usable manner the best possible strategies and design decisions for providing Adaptive Learning, using the medium of design patterns. Via the exchange of experience and expertise of the SIG members will create a repository of design patterns that will guide the R&D community in designing usable adaptive learning systems.

References

[Alexander 77] C. Alexander, S.Ishikawa, M. Silverstein, M. Jacobson, I. Fiksdahl-King and S. Angel: "*A Pattern Language*". Oxford University Press, New York 1977.

[Borchers 01] Jan Borchers, *A pattern approach to interaction design*, John Wiley, 2001.

[Buschmann et al. 96] Buschmann F., R. Meunier, H. Rohnert, P. Sommertland and M. Stal, "*Pattern-Oriented Software Architecture, Volume 1: A System of Patterns*", John Wiley & Sons, 1996.

[Bra & Calvi 2000] P. De Bra and L. Calvi. AHA! An open Adaptive Hypermedia Architecture, The New Review of Hypermedia and Multimedia, vol. 4, pp 106-112 (2000).

[Brusilovsky 96] P. Brusilovsky. Methods and Techniqes of adaptive hypermedia. User Modeling and User Adapted Interaction, vol. 6, pp 87-129, 1996.

[Brusilovsky 98] P. Brusilovsky. Adaptive educational systems on the world-wide-web: A review of available technologies. In Proceedings of Workshop WWW-Based Tutoring, 4th International Conference on Intelligent Tutoring Systems (ITS'98), San Antonio, TX, 1998.

[Rossi et al. 96a] G. Rossi, A. Garrido and S. Carvalho. "Design Pattern for Object-Oriented Hypermedia Applications. *Pattern Languages of Program Design, Vol. 2*, chapter 11, pp. 177-191. Vlissides, Coplien y Kerth editors, Addison-Wesley, 1996.

[Gamma et al 94] E. Gamma, R. Helm, R. Johnson and J. Vlissides, *Design Patterns: Elements of Reusable Object-Oriented Software*, Addison-Wesley, 1994.

[Schmidt et al. 00] 1. Douglas Schmidt, Michael Stal, Hans Rohnert, Frank Buschmann, "*Pattern-Oriented Software Architecture, Volume 2: Patterns for Concurrent and Networked Object*s", John Wiley & Sons, 2000

Attachment B Overview of produced patterns

Name of pattern	content	format	method	user	keywords
1. Asynchronous collaborative learning	technical	E-len	deductive	software engineer	Communication
2. Management of on-line questionnaires	technical	E-len	deductive	software engineer	Assessment
3. Student group management	technical	E-len	deductive	software engineer	Organisation of group work
4. Study toolkit	technical	E-len	deductive	software engineer	Learning support
5. Synchronous collaborative learning	technical	E-len	deductive	software engineer	Communication
6. Course creation and customization	technical	E-len	deductive	software engineer	Learning support Work space
7. E-book delivery	technical	E-len	deductive	software engineer	Learning support Work space
8. Student Assignments Management	technical	E-len	deductive	software engineer	Assessment
9. Student tracking	technical	E-len	deductive	software engineer	Learning support (planning) Monitoring support (instructor)
10. Lifelong learner profile	educational	E-len	Inductive/ deductive	Course developers	Learning profile
11. Support choices by providing feedback on collaborative behaviour	Technical/ educational	E-len	Inductive/ deductive	(coaches of) lifelong learners	Learning support
12. Forming groups for collaborative learning	educational	E-len	Inductive/ deductive	instructors	Organization of group work
13. Making online learners trust each other	educational	E-len	Inductive/ deductive	Instructors/ on-line coaches	Trust
14. Moderation of asynchronous online groups	educational	E-len	Inductive/ deductive	Instructors/ moderators of	Organisation of group work

				asynchronous learning	
15. Provide personal identity information	Technical/ social[9]	E-len	Inductive/ deductive	software engineer	Trust Work space
16. Support identifiable types of communication	Technical/ social	E-len	Inductive/ deductive	software engineer	Communication
17. Scripted collaboration	Technical/ educational	E-len	Deductive / inductive	software engineer	Communication Organization of group work
18. Forming groups for group work within a classroom context	educational	E-len	Inductive/ deductive	instructor	Organization of group work
19. Forming groups for collaborative knowledge building	educational	E-len	Deductive / inductive	instructor	Organization of group work
20. Collaborative awareness	educational	E-len	Inductive	Software engineer	Work space
21. Motivation	educational	E-len	Inductive	Instructor	Organisation of group work
22. Private and public spaces	technical	E-len	Inductive	Software engineer	Work space
23. Virtual assistant	technical	E-len	Inductive	Software engineer	Learning support
24. Learning in a 3-D world	educational	E-len	Inductive	Instructor	Work space Learning support
25. Demographic data	Technical	E-len	Inductive/ deductive	Software engineer	Work space
26. User goals	Technical	E-len	Inductive/ deductive	Software engineer	Work space
27. User model definition	Technical	E-len	Inductive/ deductive	Software engineer	Work space
28. User model initialisation	Technical	E-len	Inductive/ deductive	Software engineer	Work space
29. User model maintenance	Technical	E-len	Inductive/ deductive	Software engineer	Work space
30. User preferences	Technical	E-len	Inductive/ deductive	Software engineer	Work space

[9] Social is being coded as educational

31. Student know your past	technical	E-len	Deductive	Software engineer	Work space
32. Shape electronic environment for interactivity	Educational/ technical	E-len	deductive	software engineer	Work space Organisation of group work
33. Studying together	Educational	E-len	Inductive	Learner	Learning support
34. Student interaction in groups	educational	E-len	inductive	instructor	Organisation of group work

Attachment C Overview of produced patterns (whole text)

Asynchronous collaborative learning

Maturity level

Category

Learning patterns

Problem

How to allow and facilitate learners and instructors to asynchronously collaborate and interact, in order to engage learners in processes such as problem-solving and critical thinking, and to be able both to mentor and to assess these interactions?

Analysis

When students work together they learn from one another and extend their interaction and learning outside of class. Busy schedules and commuting students often make group work difficult to coordinate. When properly applied, technology can eliminate these barriers to collaboration. The main goals for asynchronous collaboration are:
to provide a comfortable setting for contribution by all group members
to enable convenient collaboration without restrictions of time or place
to archive all the interactions that took place

Solution

Develop asynchronous computer mediated communications (ACMC) tools that can effectively and efficiently support the asynchronous collaborative learning process, due to the fact that they offer flexibility in the use of time as well as space. The most common type of ACMC tools are:

- asynchronous text-based communication, such as e-mail, mailing lists, web-based discussion fora.
- asynchronous audio or video or audio/video communication. These tools have a pool of audio or video or audio/video clips, that participants can share, annotate, and asynchronously discuss various subjects about them.

Known uses

Most LMS provide both customized e-mail client-servers and discussion fora and also tools for creating group mailing lists.

Context

This pattern is applicable to software engineering teams that develop Learning Management Systems. When implemented, its end-users shall be learners and instructors.

References

P. Avgeriou, A. Papasalouros, S. Retalis, Manolis Skordalakis, ?Towards a Pattern Language for Learning Management Systems?, ???? Educational Technology & Society, Volume 6, Issue 2, pp. 11-24, 2003.
P. Avgeriou, A. Papasalouros, S. Retalis, ?Patterns For Designing Learning Management Systems?, proceedings of the European Pattern Languages of Programming (EuroPLOP) 25th?29th June 2003, Irsee, Germany.

Related patterns

Student group management
Synchronous collaborative learning
Student Assignments Management

More information on relations

Author(s)

P. Avgeriou, S. Retalis, A. Papasalouros

Type

Domain specific

Submitted date

2004-03-19

Management of on-line questionnaires

Maturity level

Category

Learning patterns

Problem

How can web-based questionnaires be created, delivered and graded?

Analysis

One of the main learning activities of the instructional process is students? assessment. Assessment is one of the main mechanisms for checking and monitoring students? level of knowledge. It is very beneficial for the instructor to assign particular questions to learning units where the student should check the knowledge she/he is supposed to have obtained. Assessment can be automated in order to save instructors? time and effort in delivering and grading tests. Automation also offers to learners the ability to perform assessment without any time and place constraints. However, the on-line administration (creation, delivery and grading) of tests for the assessment of students is a complicated task.

Solution

Provide tools for the on-line assessment of learners through questionnaires.
The system should enable the instructors to:

- create on-line both closed-end questions with predefined answers, that are able to be automatically graded and open-end questions, that need to be graded by an instructor

- create/edit on-line closed-end questions of various types: multiple choice, fill-in the blanks, etc. and easily mention the corresponding right and wrong answers. The hint messages and/or feedback messages that will be shown to the student in case of wrong and/or right answer should be stated.

- administer the delivery of the online test. More specifically, the instructor should be able to state how many times an online test can be answered by the student, the duration of the assessment (time limits), to announce the schedule of on-line tests as well as their grading so that students get informed on time

- be able to allocate a grade to each question of a test separately and/or to the whole test updating the students' records

- search for possible questions, that could be integrated into a newly made test, in a pool of already made online tests. In some cases it is valuable to import a ready made questionnaire that has been created in another LMS. Conformance to an international standard is necessary in this case.

The system can optionally support adaptive question sequencing, customizing the succession according to which the questions are given to the learner. The answer to a particular question (right or wrong) might change the sequence of the next questions and the related study material according to specific sequencing rules.
It is recommended that the produced questionnaire conforms to an international e-Learning Standard. The most widely adopted standard for this case is the IMS Question and Test Interoperability (http://www.imsproject.org/). Such a conformance will greatly enhance the portability of the learner profile as well as the interoperability of software systems that utilize the learner profiles.

Known uses

All LMS that were reviewed have some mechanism for on-line questionnaires.

Context

This pattern is applicable to software engineering teams that develop Learning Management Systems. When implemented, its end-users shall be learners and instructors.

References

1. 1. P. Avgeriou, A. Papasalouros, S. Retalis, Manolis Skordalakis, “Towards a Pattern Language for Learning Management Systems”, IEEE Educational Technology & Society, Volume 6, Issue 2, pp. 11-24, 2003..

2. P. Avgeriou, A. Papasalouros, S. Retalis, “Patterns For Designing Learning Management Systems”, proceedings of the European Pattern Languages of Programming (EuroPLOP) 25th–29th June 2003, Irsee, Germany.

Related patterns

Student tracking
Student Assignments Management

More information on relations

Author(s)

P. Avgeriou, S. Retalis, A. Papasalouros

Type

Domain specific

Submitted date

2004-02-24

Student group management

Maturity level

Category

Learning patterns

Problem

How should groups of students be created and managed, and how can projects be assigned to these groups?

Analysis

One of the most complicated tasks of both traditional and on-line courses is the management of groups of students. Students must be grouped in working teams, their progress should be tracked during the project time, and ways of communication between the members of the group and the supervising instructor must be established. In addition there must be some repository for the artifacts of the projects assigned to these groups and a mechanism for grading the students.

Solution

Provide a tool for the creation of groups of students. The groups can be created either manually, by the instructors, or automatically by the system. The tool should also provide the ability to assign projects to groups, and, optionally, allocate space for the project deliverables, as well as provide a mechanism for the easy upload of these deliverables from group members. The communication between the members of the group should be established through asynchronous (e-mail, discussion forums) or synchronous (chat, video conference) mechanisms. The system should permit the supervisor of each project to participate in the communication sessions between the members of the groups, to track their progress by reviewing the artefacts of the project and to grade each student at the end of the project. More specifically the instructor should be able to: More specifically the instructor should be able to:

- announce the subjects of the assignments as well as to specify related learning resources (either online or offline) and ask the learners to form groups and choose subject (in case of more than one)
- see conflicts in the students' choices (e.g. more than one group has chosen the same subject)
- accept or reject the students' selection of subject. In the latter case, he or she should be able to allocate other subjects to them. Moreover, the instructor could be able to manually change the synthesis of the group
- communicate with the members of the group. The contact information of the group members should be extracted from the LMS database

mention whether the students' deliverables will be publicly available or not
grade the students' deliverables

The learner should be able to:

- access the proposed subjects of the assignments and get informed about allocations up to that point
- choose a proposed subject of the assignments and state the rest of the group members
- upload the deliverables for the assignments and optionally view the deliverables of the other groups.
- Communicate synchronously or asynchronously with other members of their group and collaborate with them.

Known uses

Blackboard, CoSE, FirstClass, Convene, LearningSpace and WebCT provide tools for the creation and the management of workgroups of students. Gentle WBT has a tool for the definition of working groups, which is available to all types of users.

Context

This pattern is applicable to software engineering teams that develop Learning Management Systems. When implemented, its end-users shall be learners and instructors.

References

P. Avgeriou, A. Papasalouros, S. Retalis, Manolis Skordalakis, "Towards a Pattern Language for Learning Management Systems", IEEE Educational Technology & Society, Volume 6, Issue 2, pp. 11-24, 2003..
P. Avgeriou, A. Papasalouros, S. Retalis, "Patterns For Designing Learning Management Systems", proceedings of the European Pattern Languages of Programming (EuroPLOP) 25th–29th June 2003, Irsee, Germany.

Related patterns

Study toolkit
Student Assignments Management
Asynchronous collaborative learning
Synchronous collaborative learning
Student tracking

More information on relations

Author(s)

P. Avgeriou, S. Retalis, A. Papasalouros

Type

Domain specific

Submitted date

2004-02-24

Study toolkit

Maturity level

Category

Learning patterns

Problem

How can the learners be assisted in studying the learning resources instead of being limited to reading simple HTML pages?

Analysis

There are many facets to this problem. A first one is that most learners find it difficult to study on-line material because they are used to particular methods of studying paper-based courseware and can't get accustomed to reading from the screen passively. When reading paper-based material, learners usually underline or highlight words or phrases, place bookmarks on particular pages, make annotations on the side etc. These functions obviously can't be performed on a plain web page and they need to be incorporated as an explicit service of the LMS. Moreover, instructors often wish to mark or make annotations on students? assignments or deliverables or even web pages of the learning material in order to pinpoint some critical issues and disseminate either publicly or privately to the learners. Another facet of this problem is that learners can't remain connected to the server for many hours for financial reasons (e.g. connection through a dial-up modem) or because they have problems with their connection (limited bandwidth, server down, network congestion). In this case the learners need to download the learning material, store it locally on their computer and use it whenever they want to. Of course this is not a simple download problem, since the learning material may be comprised of numerous pages, linked implicitly through the LMS navigational mechanisms, may have an LMS-made table of contents etc. Finally another facet of this problem is that learners do not want to do on-line studying at all and would rather print the material and read it from paper. Once again this is not a simple download problem, as described earlier.

Solution

Provide a study toolkit for the learners to use, which will facilitate them in studying the courseware according to their own preferences. This tool should offer them a set of tools that allow the user:

- to underline, strikethrough and highlight sentences using various color pens for creating annotations on the text
- to put bookmarks on point of interest and/or make comments within the hypertext using either ?free text? or specific notations, i.e. a specific symbol should mean ?question mark?, ?criticism?, etc.

- to add annotations in any format (text, image, hyperlink, audio, video)
- to characterize an annotation as private or public
- to search for annotations by making queries with respect to the date, the author, or the annotation type.

The annotation tools should also allow the user to ?compile? the learning material in such a format that can be downloaded and stored locally, and which will allow them to add annotations or comments that could be easily 'uploaded' to the LMS.

Known uses

WebCT, VirtualU, Blackboard, CoSE, Intralearn, TopClass, LearnLinc, FirstClass and LearningSpace provide the ability to set bookmarks, while CoSE, Intralearn, FirstClass and LearningSpace provide annotation tools but with less functionality than the one described above. WebCT and BlackBoard provide the tools for ?compiling? the learning content in a downloadable and printable format.

Context

This pattern is applicable to software engineering teams that develop Learning Management Systems. When implemented, its end-users shall be learners and instructors.

References

1. P. Avgeriou, A. Papasalouros, S. Retalis, Manolis Skordalakis, “Towards a Pattern Language for Learning Management Systems”, IEEE Educational Technology & Society, Volume 6, Issue 2, pp. 11-24, 2003..
P. Avgeriou, A. Papasalouros, S. Retalis, “Patterns For Designing Learning Management Systems”, proceedings of the European Pattern Languages of Programming (EuroPLOP) 25th–29th June 2003, Irsee, Germany.

Related patterns

E-book delivery
Student Assignments Management

More information on relations

Author(s)

P. Avgeriou, S. Retalis, A. Papasalouros

Type

Domain specific

Submitted date

2003-01-29

Synchronous collaborative learning

Maturity level

Category

Learning patterns

Problem

How to allow and facilitate learners and instructors to interact synchronously, collaborate and co-operate with peers?

Analysis

Synchronous collaborative learning is a computer-mediated effort that simulates face-to-face interaction. Since body language and facial expressions cannot be conveyed through asynchronous communication, real-time communication allows contributions participation, sharing information and social dialogue at a distributed environment. The main advantages of synchronous multimedia communication are:
"Next best thing to being present at a lecture hall"
Very visual medium: students and teachers can begin to relate to one another.
Good for distance education novices for developing a "learning community"

Solution

Develop synchronous multimedia communication tools, which make it possible for learners and instructors at different sites to partake in the same conference at the same time through text, or the "magic" of two-way audio and two-way compressed video. Examples of these tools include:

- text-based Internet chats
- instant messaging
- audio & video conferencing
- virtual whiteboard applications
- shared applications

Known uses

Most LMS provide some sort of chat or conferencing service

Context

This pattern is applicable to software engineering teams that develop Learning Management Systems. When implemented, its end-users shall be learners and instructors.

References

P. Avgeriou, A. Papasalouros, S. Retalis, Manolis Skordalakis, ?Towards a Pattern Language for Learning Management Systems?, IEEE Educational Technology & Society, Volume 6, Issue 2, pp. 11-24, 2003.
P. Avgeriou, A. Papasalouros, S. Retalis, ?Patterns For Designing Learning Management Systems?, proceedings of the European Pattern Languages of Programming (EuroPLOP) 25th?29th June 2003, Irsee, Germany.

Related patterns

Asynchronous collaborative learning
Student group management
Student Assignments Management

More information on relations

Author(s)

P. Avgeriou, S. Retalis, A. Papasalouros

Type

Domain specific

Submitted date

2004-03-19

Course Creation and Customization

Maturity level

Category

Instructional patterns

Problem

How can the instructors be assisted in building on-line courses in LMS so that some of the tasks they need to perform can be automated?

Analysis

LMS need to make the job of instructors easier by providing them with easy-to-use tools for creating, and customizing their courses so that they won?t have to be experts in using the LMS, neither will they have to spend too much time and effort in performing those tasks. This way, courses will not be created from scratch, but instead instructors will reuse some design templates and easily perform generic activities and let the LMS take care of the details. For example if an instructor already has a course named ?Software Engineering: Part I? and wants to create another one for the course ?Software Engineering: Part II? that has roughly the same structure and format, she/he should not create it form scratch. Instead she/he should be able to build the new course by using the old one as a template. Also instructors should not have to perform low-level activities to customize their course but the LMS should provide the appropriate tools. For example if the instructor wants to change the background image of the course?s home page she/he should not change the corresponding HTML tag, but instead set it visually through an LMS tool. Finally courses have to be initialized in the beginning of every semester in an automatic way by resetting student accounts, deleting the old announcements, reconfiguring the calendar, cleaning the old file folders etc.

Solution

Provide the instructors with appropriate tools for creating a course and customizing it according to their preferences. The creation of courses should be based on design templates with pre-set interfaces, content structure and features or based on existing courses. Instructors should also be equipped with tools to reset the courses on every semester and easily manage the appearance, structure and features of their courses, doing as few things manually as possible. User interfaces that allow the instructors to perform the aforementioned tasks should emphasize usability issues, especially in order to relieve the instructors of cognitive overload from learning to use the LMS.

Known uses

WebCT, VirtualU, Blackboard, Intralearn, TopClass, LearnLinc, FirstClass, Convene and LearningSpace provide templates for course creation as well as tools for customizing the various courses characteristics.

Context

This pattern is applicable to software engineering teams that develop Learning Management Systems. When implemented, its end-users shall be learners and instructors.

References

P. Avgeriou, A. Papasalouros, S. Retalis, Manolis Skordalakis, ?Towards a Pattern Language for Learning Management Systems?, ???? Educational Technology & Society, Volume 6, Issue 2, pp. 11-24, 2003.
P. Avgeriou, A. Papasalouros, S. Retalis, ?Patterns For Designing Learning Management Systems?, proceedings of the European Pattern Languages of Programming (EuroPLOP) 25th?29th June 2003, Irsee, Germany.

Related patterns

More information on relations

Author(s)

P. Avgeriou, S. Retalis, A. Papasalouros

Type

Domain specific

Submitted date

2004-03-19

E-book delivery

Maturity level

Category

Instructional patterns

Problem

How can the instructors be facilitated with an easy and consistent way of creating and structuring electronic course books using hypermedia content?

Analysis

No matter what learning theory and instructional design strategy is adopted by the Instructors or Institutions, the dissemination of learning content in the form of a set of web pages delivered over the web is common in every web-based system facilitating learning processes. The learning content must be structured, have consistent style and layout and provide a uniform and self explanatory user interface metaphor allowing its users (Students) to easily navigate into the hypertext.

Solution

Provide tools that facilitate the instructors to create on-line books in an easy to use fashion.
The system must enable the Instructor to:

- structure the learning content into aggregated logical sets of web pages (i.e. chapters) in a hierarchical manner. These web pages can be uploaded to the system or created from scratch. A run-time system will automatically present the structure content to learners providing appropriate controls for navigation (i.e. next/previous page, next chapter, etc).
- Integrate the actual learning content with other tools related to studying. This is done by associating particular learning resources, i.e. web pages or chapters, to specific tools that manage glossary terms, multiple choice questions, links to other resources, search engines, etc.
- save the created study material in a standardized, interchangeable format, such as the IMS Content Packaging format, so as to be able to reuse the structured content in the same, or different LMS.

Known uses

WebCT, Blackboard, VirtualU, COSE, Intralearn, TopClass, LearnLinc, FirstClass, and LearningSpace provide instructors with tools for the creation and management of an electronic book.

Context

This pattern is applicable to software engineering teams that develop Learning Management Systems. When implemented, its end-users shall be the instructors.

References

P. Avgeriou, A. Papasalouros, S. Retalis, Manolis Skordalakis, “Towards a Pattern Language for Learning Management Systems”, ???? Educational Technology & Society, Volume 6, Issue 2, pp. 11-24, 2003.
P. Avgeriou, A. Papasalouros, S. Retalis, “Patterns For Designing Learning Management Systems”, proceedings of the European Pattern Languages of Programming (EuroPLOP) 25th–29th June 2003, Irsee, Germany.

Related patterns

Study toolkit

More information on relations

Author(s)

P. Avgeriou, S. Retalis, A. Papasalouros

Type

Domain specific

Submitted date

2004-02-24

Student Assignments Management

Maturity level

Category

Instructional patterns

Problem

How to create on-line assignments for students?

Analysis

Assigning exercises and projects to students is a common practice for instructors. In the context of a web-based LMS certain matters have to be resolved: How to communicate issues concerning the assignments to students, how to grade students, etc.

Solution

Provide a tool for instructors to manage assignments. An instructor should be able to:

- define an assignment by describing the title of the assignment, a description, links to on-line resources, start and due date etc.
- notify the learners about a new assignment
- receive the learner's papers
- grade the papers and make the grades or the corrected papers available to the learners.

A learner should be able to:

- be notified for the assignment and prepare their documents for submission.
- upload the corresponding documents can or send them to the instructor via e-mail.
- Be notified that their papers have been graded and either view their grade or view the whole paper returned with the instructor's remarks

Known uses

Virtual-U, WebCT, COSE, Intralearn, Saba, Blackboard, FirstClass, Convene and LearningSpace provide tools for assignments management.

Context

This pattern is applicable to software engineering teams that develop Learning Management Systems. When implemented, its end-users shall be learners and instructors.

References

P. Avgeriou, A. Papasalouros, S. Retalis, Manolis Skordalakis, ?Towards a Pattern Language for Learning Management Systems?, IEEE Educational Technology & Society, Volume 6, Issue 2, pp. 11-24, 2003.
P. Avgeriou, A. Papasalouros, S. Retalis, ?Patterns For Designing Learning Management Systems?, proceedings of the European Pattern Languages of Programming (EuroPLOP) 25th?29th June 2003, Irsee, Germany.

Related patterns

Asynchronous collaborative learning
Synchronous collaborative learning
Student tracking

More information on relations

This pattern is also related to the Student Group Management Pattern in the sense that they both facilitate a problem-based instructional approach. The main difference between the two is that while in the former, assignments are disseminated to the whole class and require personal work of each individual student, in the latter, groups are created in order to encourage the collaboration of students along with the supervision of an instructor.

Author(s)

P. Avgeriou, S. Retalis, A. Papasalouros

Type

Domain specific

Submitted date

2004-03-19

Student tracking

Maturity level

Category

Instructional patterns

Problem

How can the instructors track the students? progress while they interact with the LMS ?s various features? On the other hand, how can the students be informed of what activities they have already performed in a course?

Analysis

In the traditional classroom, instructors watch the students? progress, monitor their various activities, evaluate them and coach them so that they learn as effectively as possible. In the virtual world of LMS, instructors do not interact physically with the students and thus cannot observe them and supervise their learning. For example the instructors do not know whether the students have studied the appropriate learning resources, practiced the on-line exercises, collaborated with their colleagues in their projects, or read the announcements for a course. On the other hand, in large and multifaceted courses, the students do not know which parts of the LMS they have already seen, what remaining tasks do they have to perform etc.

Solution

- Keep records of the students's activities in terms of which parts of the course they have visited and how long they have spent in them, what tools they have used, and maintain files of the interactions that took place in chat rooms, discussion fora etc.
- observe these records and assess the various activities that students perform, for example by presenting him with statistics about the students's actions.
- check the extend by which a particular learner has accessed the learning material in a specific course
- check whether a student has submitted an his assignments on time or not
- check the degree of participation of a student in collaboration activities i.e. discussion for a, synchronous communication sessions, etc.
- The system must enable the learner to:
- observe a log of their personal history so that they know where they have already gone and what remains to be seen.

Known uses

WebCT, Blackboard, Intralearn, Saba, FirstClass, Convene and LearningSpace provide tools for tracking the progress of students. On the other hand WebCT, VirtualU, Blackboard, Intralearn, Saba, FirstClass and LearningSpace provide tools for informing students of their own study progress.

Context

This pattern is applicable to software engineering teams that develop Learning Management Systems. When implemented, its end-users shall be learners and instructors.

References

P. Avgeriou, A. Papasalouros, S. Retalis, Manolis Skordalakis, ?Towards a Pattern Language for Learning Management Systems?, IEEE Educational Technology & Society, Volume 6, Issue 2, pp. 11-24, 2003.
P. Avgeriou, A. Papasalouros, S. Retalis, ?Patterns For Designing Learning Management Systems?, proceedings of the European Pattern Languages of Programming (EuroPLOP) 25th?29th June 2003, Irsee, Germany.

Related patterns

E-book delivery
Management of on-line questionnaires
Student group management
Student Assignments Management

More information on relations

Author(s)

P. Avgeriou, S. Retalis, A. Papasalouros

Type

Domain specific

Submitted date

2004-03-19

Life long learner profile

Maturity level:

Category:
pedagogical

Problem:
How can the profile of a life-long learner be described?

Context:
You are a life-long learner and you aim to create a description of yourself, so that it fully characterizes your individual. As a life-long learner you depend on yourself to create your own profile and use it to take part in various life-long learning activities.

Motivation:
A life-long learner is engaged in learning opportunities for the most part of his life in order to pursue personal development and fulfillment. There must be some formal form of defining the various characteristics of the life-long learner, in other words his/her *profile*, for a number of reasons:

- Life-long learners move from one learning activity to another and from one LEARNING PROVIDER to another. His/her academic record and course credit must follow the learner during these transitions.
- The life-long learner is responsible of negotiating with a learning provider about the offering of a specific learning opportunity. The learning provider usually requires to check the learner's profile in order to make sure that the learner satisfies the prerequisites of that course.
- Organizations that are responsible for training programs of life-long learners should be responsible for locating the appropriate learners through their profiles.

Solution:
Define the profile of a life-long learner in a formal way. This profile must be comprised of at least the following elements:

- the LEARNING STYLES that the learner has with respect to the various dimensions of the learning opportunity, e.g. the formal, informal or non-formal learning.
- the LEARNER GOALS**,** that the learner is trying to achieve by participating in a learning opportunity, e.g. to obtain a degree or a qualification, to develop his personal interests etc.
- LEARNER NEEDS, such as personal, social or employment-related.
- the LEARNER CAPABILITIES, that are knowledge or skills that the learner already has and will assist him/her in participating in a learning opportunity

- the LEARNER INTERESTS, that the learner has with respect to some particular domain, e.g. the interest in a particular scientific field
- the LEARNER PREFERENCES that the learner has with respect to the formalities of the learning opportunity, e.g. the price of the course, the teaching venue etc.
- the DEMOGRAPHIC DATA, which are personal characteristcs, e.g. age, gender, probable disabilites etc.

Known uses
The most well-established solution for this pattern is an international e-Learning Standard, the IMS Learning Information Package Specification (http://www.imsproject.org/).

Related patterns:
LEARNING NEGOTIATION, LEARNING OPPORTUNITY DESCRIPTION, LEARNER INTERESTS, LEARNING STYLES, LEARNER, GOALS LEARNER CAPABILITIES.

Author (s):

Date:
10/9/2003

Support choices by providing feedback on collaborative behaviour

Maturity level

Category

Not available yet

Problem

Lifelong learners experience problems of information overload, missing information relevant for their choice and increasing "selection time" (time necessary to make a choice) while trying to select effective learning activities out of a large set of possibilities.

Analysis

In models of Lifelong learning, learning is not restricted to formal, organised governmental educational settings over a relatively short period of time, but has become each individuals own lifetime responsibility. Lifelong learning implies low threshold, accessible learning activities which can be selected by the user when and where necessary. In order to decide and select useful learning activities, a user needs information to base his or her decisions on. He/she needs to know which learning activities are suitable to reach self-defined aims, how effective the learning activities are in accomplishing these aims and in what order these activities can best be performed if several collections of activities and routes through activities are available.

Some information is inherent to a learning activity (e.g. the knowledge domain from which it stems) and can be expressed in metadata. Other information can only be attained by evaluating how others performed on learning activities offered (e.g. time necessary to complete learning activity, scores on final tests).

Such an approach is also used by Amazon, where feedback is provided on collective behaviour to help individual users with selecting which product he/she might like (e.g. ‘customers who bought this book also bought’, ‘customers interested in this title may also be interested in’). Providing easy interpretable information of collective behaviour and results of activities in a network of learning activities can support individual users in making their choices while guiding their own learning process.

Presenting information about personal behaviour and displaying it to others can cause problems on privacy matters.

Solution

The provision of feedback information on collective behaviour through a network of learning activities can support an individual lifelong learner in making choices.

Agregate collective user behaviour and provide feedback of this collective behaviour to the individual user in the form of easy-perceivable dynamic (=adaptive depending on user behaviour) social navigational aids. This aggregation can be based on passive as well as active information provision by the user.

As Wexelblat (1999) mentions, with passive provision of interaction history information is recorded and made available without conscious effort of the user, ‘usually as a byproduct of everyday use of objects’ (e.g. buyers advice aggregated from user boughts in Amazon). With active provision conscious activity of the user is required (e.g. movie rating in MovieLens to come to Movie recommendations).

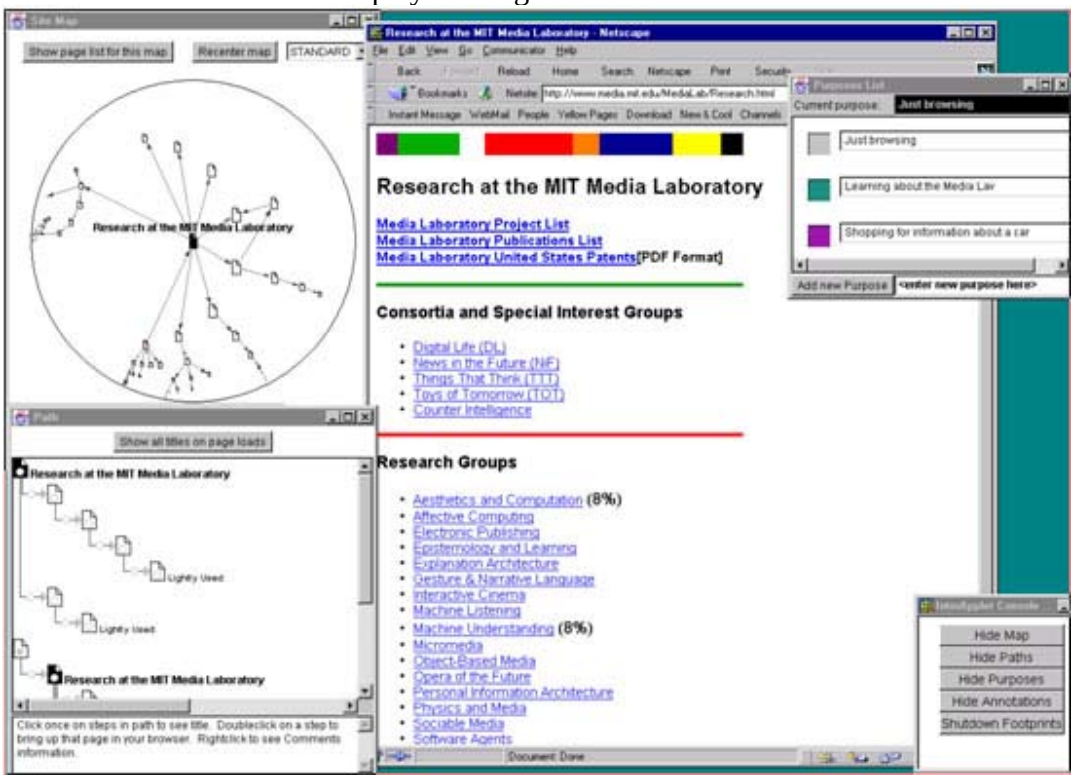
Make individual users aware of the recording of personal behaviour through a network of learning activities and let them agree to display this information in aggregational form to others. By aggregating collective user behaviour personal behaviour becomes more anonymous, dependent on the amount of interactions and users.

Known uses

Several applications of this design principle are known, for example MovieLens, Launch and Amazon, but few educational environments use mechanisms of social navigation to support learners aims and choices.

One project called Footprints at MIT Media Laboratory records the activity of users through nodes of websites and records the activity and the paths (sequency of nodes = websites) users take through the websites.

This information is displayed to an individual user in different navigational aids. An overview of these aids are displayed in figure 1.



In the left upper-corner a map with aggregated paths throught the website is displayed,

In the left lower-corner a tree-structure with the aggregated sequences (trails) through the websites, derived from the paths taken by individual users (sequences), starting from one specific website (black colour-coded) is displayed.

These displays depend on the purpose a user has specified and are related to the activity of users with the same purposes. Next to this, annotations in the form of percentages are given on the website. These annotations specify the percentage of people visiting this page who followed each of the links off the page. It is essentially the same information as in the trails, only less specific. This information can help users select web-sites which are relevant to their aims and based on an passive, aggregated ‘user-advice’ of others.

Another system which records and displays this information in a visual manner is VISVIP by the National Institute of Standards Technology, but this information at this moment only serves website developers and usability engineers to improve their navigational design, rather than giving feedback to the user.

Context

Applicable to lifelong learning environments which can be constructed dynamically around the aims and actual behaviour of lifelong learners in networks. Social navigational

information may also distract users from their actual intention (their invididual task) when not presented in an user-supportive way. In addition, not all privacy matters and considerations are clear.

References

Amazon.com. http://www.amazon.com/

Cugini, J, Scholtz, J. VISVIP: 3D Visualization of Paths through Web Sites. Information Technology Laboratory. National Institute of Standards and TechnologyRetrieved May 2004 from: http://csdl.computer.org/dl/proceedings/dexa/1999/0281/00/02810259.pdf

Dieberger, A., Dourish, Höök, K., Resnick, P., Wexelblat, A.(2000). Social navigation: techniques for building more usable systems. Interactions, november + december 2000. Retrieved June 2004 from: http://delivery.acm.org/10.1145/360000/352587/p36-dieberger.pdf?key1=352587&key2=6695578801&coll=portal&dl=ACM&CFID=23508933&CFTOKEN=1584669

Eick, S.G.(2001). Visualizing Online Activity. Communications of the ACM. Augus. Vol.44, No.8. Retrieved June 2004 from: http://delivery.acm.org/10.1145/390000/381710/p45-eick.pdf?key1=381710&key2=9690536801&coll=portal&dl=ACM&CFID=22107544&CFTOKEN=87860324

GroupLens. GroupLens Research. Department of Computer Science and Engineering at the University of Minnesota. June 2004 retrieved from: http://www.grouplens.org/index.html . (This page was last updated on Friday, May 23, 2003).

Hong, J., Heer, J., Waterson, S., Landay, J. (2001). WebQuilt: A proxy-based approach to remote web usability testing. ACM Transactions on Information Systems, Vol. 19, No. 3, July 2001, Pages 263–285. http://delivery.acm.org/10.1145/510000/502118/p263-hong.pdf?key1=502118&key2=9241536801&coll=portal&dl=ACM&CFID=22107544&CFTOKEN=87860324

Kohavi, R., Round, M. (2004). Emetrics summit 2004. Front Line Internet Analytics at Amazon.com. July 2004 retrieved from: http://robotics.stanford.edu/users/ronnyk/emetricsAmazon.pdf

Launch. http://launch.yahoo.com/

Morse, E., Steves Potts, M. CollabLogger: a tool for visualizing groups at work. Retrieved June 2004 from: http://csdl.computer.org/dl/proceedings/wetice/2000/0798/00/07980104.pdf

Wexelblat, A., Maes, P. (1999). Footprints: history-rich tools for information foraging. CHI ‘99 Pittsburgh PA USA. Retrieved June 2004 from: http://delivery.acm.org/10.1145/310000/303060/p270-wexelblat.pdf?key1=303060&key2=2334847801&coll=portal&dl=ACM&CFID=22107544&CFTOKEN=87860324

Wexelblat, A. (1999). History-based tools for navigation. IEEE. 32nd Hawai\'i International Conference on System Sciences (HICSS\'99). Retrieved June 2004 from: http://web.media.mit.edu/~wex/HICSS-32.html

Wexelblat, A.(1999). Social navigation: what is it good for? CHI 99. Retrieved June 2004 from : http://delivery.acm.org/10.1145/640000/632771/p89-wexelblat.pdf?key1=632771&key2=2986578801&coll=GUIDE&dl=ACM&CFID=23509528&CFTOKEN=73616698

Related patterns

More information on relations

Author(s)

Ellen Rusman

Acknowledgement: Colin Tattersall

Type

Generic

Submitted date

2004-07-14

Forming groups for collaborative learning

Maturity level

Category

not available yet

Problem

How can a well functioning group for collaborative learning in an educational context be formed?

Analysis

When you want to introduce collaborative learning within your classroom, you have to be aware of several choices to make when forming groups in order to make interaction as fruitful as possible. If you want to form groups for collaborative learning you'll have to:

- decide who forms the group; the participants themselves or the teacher; ?decide what sort of group you want to form (informal, formal or base, heterogeneous or homogenous);
- decide on group size. These aspects have effect on positive interdependence and the creation of commitment and therefore the successfulness of the group. You can also make choices concerning the procedure to follow to form the groups.

Solution

Who forms the group: If you allow the students to form the groups themselves, they often cluster with friends. If somebody not belonging to the already existing cluster joins, (s)he may feel left out. Moreover friends seem to agree a lot which prevents them of meeting with new perspectives and diversity of ideas. Conclusion: it's best for the teacher or instructor to form the groups for collaborative learning instead of student-selected groups.

Sort of group: Informal groups exist only shortly, for example during a meeting when one is asked to discuss something within the context of for example a lecture with ones neighbor(s), who can be someone else every other day. Formal groups exist during a certain period and have a better defined goal to reach (for instance an assignment of project to accomplish) which needs more structure. Base groups resemble formal groups but last even longer then a project; members are chosen for their specific experience and the strength enhances as longer as the group exists. Homogenous groups are most likely to exist within a classroom, in which the students resemble the amount of prior knowledge, goal(s) to reach, age and (life) experience. Also previously acquired social skills to communicate and collaborate within the group are aspects to take into account. Differences in these make the group more heterogeneous. It seems logical that

heterogeneous groups lead to more interaction and therefore to more profound knowledge building and better considered solutions.

Group size: The group has to be small enough to give everybody the opportunity to participate and prevent participants to hide. It should also be small enough to prevent the group of losing time to come cohesive and structure and schedule. On the other hand the group has to be large enough to provide sufficient diversity of opinions and backgrounds as well as resources to get the job done. Group size is connected to the character or sort of the group. The more informal and short-lasting the group, the smaller it should be. Depending on the goal and the existence of the group, the ideal size is 4 to 6 students. More informal groups should even be smaller. A different rationale to limit the number of groups (affecting the group size) can be the number of tutors or coaches to monitor and coach the group (or time the tutor can spend coaching each group).

A way to form groups is simply to select the first students on an alphabetical ordered list. Doing so, you will probably combine male and female students, friends and non-friends. An other way is to make them draw numbers from a box (as many numbers as you want groups to emerge) and join the numbers one, numbers two, etc. Within an educational context most times information is available on the (probably similar) background of students or participants in a course. This enables the instructor to guarantee the heterogeneity. A third way to form groups is related to (differing) topics or themes each group is supposed to work on. Students then select a group based on the topic. Of course one should be aware of the above mentioned risks if the students themselves select the group (and thus the group members).

Known uses

Context

The solution described in this pattern seems best applicable to an educational context in which students know each other and meet on a regular basis. The groups to be formed are supposed to exist for at least for a week (enough to accomplish an assignment).

References

Cooper, J., Prescott, S., Cook, L., Smith, L., Mueck, R., and Cuseo, J. (1990). Cooperative learning and college instruction: Effective use of student learning teams. California State University Foundation, Long Beach, CA. Fiechtner, S. B., and Davis, E. A. (1992). "Why some groups fail: A survey of students' experiences with learning groups". In Goodsell, A. S., Maher, M. R., and Tinto, V. (Eds.), Collaborative Learning: A Sourcebook for Higher Education. National Center on Postsecondary Teaching, Learning, & Assessment, Syracuse University. Johnson, D. W., Johnson, R. T. (1987). Learning Together & Alone, Cooperative, Competitive, & Individualistic Learning. 2nd ed., Englewood Cliffs, NJ: Prentice Hall. Johnson, D. W., Johnson, R. T., and Smith, K. A. (1998). Active learning: Cooperation in the college classroom. Edina, MN: Interaction Book Company. Smith, K. A. (1996). "Cooperative Learning: Making 'Group work' Work" In Sutherland, T. E., and Bonwell, C. C. (Eds.), Using active learning in college

classes: A range of options for faculty, New Directions for Teaching and Learning No. 67. http://www.wcer.wisc.edu/nise/CL1/CL/moreinfo/MI3H.htm (Groups for collaborative learning) http://www.iml.uts.edu.au/learnteach/groupwork/unit3.html (Forming effective groups) http://www.inov8.psu.edu/toolbox/alex/pdf/Help-FormingGroups.pdf

Related patterns

More information on relations

Coaching small groups (not available yet) Creating and enhancing trust between group members (under construction) Factors influencing the successfulness of a group for collaborative learning Forming groups for on-line or distance collaborative learning

Author(s)

Gaby Lutgens (Learning Lab Universiteit Maastricht)

Type

Domain specific

Submitted date

2004-06-16

Making online learners trust each other

Maturity level

Category

Not available yet

Problem

How can you bring together learners in groups for collaborative learners or (online) communities) and make them trust each other?

Analysis

Nowadays people recognize more and more the need to keep informed about the constantly changing every day practice or insights after formal education. One way to do this is by subscribing for courses, which can be (partly) organized on a distance education format, or join communities of practices (COP or learning communities) emerging around a common theme or topic of interest. Main difference will be the timeframe; the course will be announced and take place according to a schedule, a COP can last as long as interaction seems fruitful. A mode to make the practitioners exchange experiences and thus learn with and from each other is forming groups for online collaborative learning. Without discussing aspects as who forms the group or group size, in this pattern attention is paid to how to invite participants and how to make them feel committed to the group. According to the guidelines offered about forming groups for collaborative learning (which advise to have the/a instructor or moderator form the groups) the members sometimes do not know each other. This may certainly be the fact if an (online) community is formed around a topic, and people can join the community based on their shared interest in the subject matter. The problem can arise that these members are not able or willing to actively involve in sharing ideas or participating in a project if they are not sure about the others participating.

Solution

To start a group, make the group cohesive and make the members trust each other?s active participation, one could follow the next steps: 1.announcing a topic and letting people subscribe (in the case the group is not formed by an instructor and/or related to a specific case); 2.well describe the topic of the (online) community for instance by using a informative introduction page; 3.well define the goal(s) and what is expected of everyone joining the group; 4.offer a tool by means to communicate and (if necessary) provide instructions; 5.spend some time in getting acquainted, for instance by starting with a name game or offering the possibility to introduce one selves on a homepage. Special attention can be given to the second and third aspect; defining the goal and making clear what is expected of the participant as a group member. It is important that the timeframe

is known, if the members are free to join at any moment they like or that you can only join before the kick-off of a certain ?project?. Within an educational context the topic will be related to the course. A COP will gather around a theme merging form everyday practice. Several tools can be offered for these online groups. It is important that every member has equal access, that everyone can contribute and read each others contributions and that the tool makes it easy to share information and relate the present information. If possible it would be useful to save (part of the) content and reuse content.

Known uses

Context

One will decide to bring learners together in online groups in the case participants do not know each other but want to share experiences or if the participants do not have the possibility to meet face-to-face to interact.

References

Stella Terrill Mann (). Cooperative & Collaborative Learning. Richard M. Felder (). Cooperative learning in technical courses: procedures, pitfalls, and Payoffs. North Carolina State University & Rebecca Brent, East Carolina University

Related patterns

Forming groups for collaborative learning

More information on relations

Active and passive contribution Defining the goal of collaboration Division of tasks and roles Factors influencing the successfulness of Communities of practice Lurking Providing structure (role and task(s) of teacher/moderator) Tools to support interaction within online groups

Author(s)

Gaby Lutgens (Learning Lab Universiteit Maastricht)

Type

Domain specific

Submitted date

2004-06-16

Moderation of an asynchronous on-line group

Maturity level

Category

Not available yet

Problem

Experience teaches that a moderator can have a positive affect on the activities and learning results of on-line groups. What should a moderator do in order to facilitate effective learning in asynchronous on-line groups.

Analysis

A moderator is always acting as a sort of chair and facilitator to a meeting. In different circumstances (dependent of the characteristics and the aim of the group) the focus of the moderator can be more on the learning subject or more on the procedures and behavior of the group. Three key-roles can be distinguished: Organizational. Examples of organizational moderating activities: setting the agenda, objectives, timetable, procedural rules, netiquette, encouraging the participants to introduce themselves, etc. The moderator should be wary of standardized approaches. Every discussion group comprises participants with different backgrounds, learning styles, etc. So, no standardized approach can be presumed to be appropriate for all groups. The moderator should use a diversity of approaches and have a pool of questions and discussion to stimulate the discussion. The moderator should also welcome the unanticipated. Discussion could be unpredictable and moderators should be prepared and willing to leave from the pre-defined track of discussion to follow up discussion threads that might arise unexpectedly. ?social Examples of social moderating activities: sending welcoming messages, thank you notices, prompt feedback, set a positive tone. The moderator should praise and model the discussant behavior bad discussant behavior should not be ignored. Reinforcing and modeling good discussant behaviors, such as by saying, "Thank You" to students who respond effectively online, can be helpful to encourage courtesy and interaction. In case competitive and emotional battlegrounds or highly personal messages will be shared, the moderator should request change (privately) using a written "netiquette" statement to refer to. The moderator should allow participants to exchange private and informal messages. In this way, trusting and social bonds can be cultivated. Of course, there should be a separate virtual place (e.g. virtual café) for such kind of interaction. intellectual. Examples of intellectual moderating activities: asking questions, probing responses, refocusing discussion. The moderator should read a digest report of the discussion activities of the day in order to check if participants fall far behind. The moderator should also prompt frequently by using private messages to motivate participants to take part in the discussion, to initiate debates, and to make suggestions. The problem is when to use what activities.

Solution

In general all of the activities mentioned above should be performed; how and how often depends on the case. It is not necessary that only the moderator is responsible for all of these activities. It is often possible to delegate part of the activities to group members. This should be agreed on because it has to be clear to every member of the group who is responsible for what. The need for moderating activities depends on: 1.desired learning effects 2.motivation and experience of the learners 3.organization of the group 4.content and form of the tasks. 5.flow of discussion (see above comments about the misbehavior, the diversion from the pre-planned topics, or even the case of having lurkers) Ad 1: If the learning goals an tasks are clearly defined, the moderator has to see to it that the right subjects are treated, and that all subjects are treated. If the learning goals are more open, a more spontaneous development of subjects is possible; the moderator can then summarize the goals as consented on by the group. Ad 2: If the members are very motivated to learn and clearly understand their gain in participating in the group, the role of the moderator can be limited to refocus and summarize the discussion from time to time. If the learners are less motivated, the role of the moderator has to be more complex. He should also try to motivate each individual participant to contribute and collaborate. This is a very important task of a moderator. Ad 3: If the group is structured and organized according to rules and procedures, the role of the moderator is to ensure these procedures are followed. If such rules do not exist, it is part of the moderator?s job to propose them to the group and have them agreed on. Ad 4: A well structured task is easier for the moderator. The structure of the task ensuring that all subjects are covered, the moderator can concentrate on motivating students. The moderator is free to define his/her preferred form of moderation and pedagogical style.

Known uses

Context

References

Kim, A. J. Secrets of Successful Web Communities : 9 Timeless Design Principles for Community-Building. Miller, J., J. Trimbur, et al. (1994). Group Dynamics : Understanding Group Success and Failure in Collaborative Learning. Collaborative Learning : Underlying Processes and Effective Techniques. K. Bosworth and S. J. Hamilton. San Francisco, Jossey-Bass: 33-44 White, N. (2001). Facilitating and Hosting a Virtual Community. Paulsen, M. F. (1995). The Online Report on Pedagogical techniques for Computer-Mediated Communication. Retrieved, from the World Wide Web: http://www.hs.nki.no/~morten/cmcped.htm Roberts, T. S. (2004) Online collaborative learning; theory and practice, Information Science Publishing Australian National Training Authority (2002), Effective Online Facilitation (Version 1.01), Australian Flexible Learning Framework Quick Guides series, Backroad Connections Pty Ltd 2002, Retrieved, from the World Wide Web: http://www.flexiblelearning.net.au/guides/facilitation.html

Related patterns

More information on relations

-Defining the goal of collaboration -Agreeing on how to collaborate -Agreements on why and how to contribute -Division of roles and tasks -Assessing group processes and products -Active and passive contribution -Lurking -Factors influencing the successfulness of a group for collaborative learning

Author(s)

Antoinette Vesseur (Learning Lab Universiteit Maastricht)

Type

Domain specific

Submitted date

2004-06-16

Provide personal identity information

Maturity level

Category

Not available yet

Problem

People are not or very sporadic collaborating due to a lack of trust and lack of a mental image of other people they ought to be collaborating with.

Analysis

One of the conditions of successful collaboration is the feeling of trust, mutual accountability and common ground between the members of a group. To build this relationship of trust and understanding between people they need to get a feeling and a mental image of the kind of person they are collaborating with. One way to get such an estimate of the person you are dealing with is to provide personal identity information in the collaborative environment. This is a representation of the user, so he/she has a personal identity within the group and one way for members to experience his/her social presence (a sense of a participant being present in an environment) during interaction with this person. In this way everyone knows who is responsible for a given message or comment. The provided information can be static (fixed) or dynamic ('build' through collaboration processes) and can be created in various ways (e.g. created by the user, created by others, generated).

Solution

Provide static as well as dynamic information on personal identity. This information can be created in different ways. Static information of a person is relatively fixed. Between different collaborative initiatives (groups in time) it can change, due to new experiences a person had. Static information can be presented in different ways, e.g. as a personal profile, with a name, a picture (photo/cartoon), the projects the person participated in, the product a person produced, a description on specific expert knowledge this person possesses, references (job experience and writings), the organisation in which the person is working, hobbies, contact information, membership of relevant communities etc. Dynamic information of a person is 'build' during the collaboration process and has different presentational formats (e.g. pictures, numbers, text) and functions. This information aims to give an overview of the role of the person within the group and thus helps other to get a mental image of the accountability of the other. Examples of the type of information are e.g. the number of times a person gave feedback, rated relevance of this feedback by other participants of the collaborative environment, frequency of active participation, frequency of non-active participation (e.g. reading), representation of

relational information of this person compared to others (core-periphery). An example of this kind of personal identity information is given in eBay, a kind of internet market. Although it can be discussed if this is a community and certainly these people are not collaborating or co-operating, this principle of representing data about a seller to create a feeling of trust by buyers might be transferable to collaborative environments. The represented personal identity information contains static (e.g. name, registration date of membership) as well as dynamic information (feedback of buyers).

Known uses

In support of collaboration: Microsoft's Team and Enterprise collaboration platform contains user profiles which include properties imported from Active Directory, links to documents a user has written, links to team sites a user belongs to, and links a user has shared. Users can customize the site with information about themselves and their skills, their background, and even other personal interests. http://www.microsoft.com/technet/itsolutions/msit/infowork/entcltsb.mspx In support of feedback on people: The Feedback Forum of Ebay is the place to learn about trading partners, view their reputations, and express opinions by leaving feedback on transactions. Such member-to-member comments help millions of buyers and sellers in the community to build trust and share their trading experiences with others. http://pages.ebay.com/services/forum/feedback.html

Context

Applicable to synchronous and a-synchronous distributed interaction in a collaborative environment. Mainly aimed at designers and developers of electronic groupware environments. Especially necessary when people don't know each other in advance and there are no opportunities to organise one or more face-to-face meetings to get a mental image of people.

References

Beck, R.J., Fitzgerald, W.J., Paukszat, B. (2003). Individual behaviors and social structure in the development of communication networks of self-organizing online discussion groups. In: Wasson, B, Ludvigsen, S., Hoppe, U. Designing for Change, p. 313-322. Danis, Catalina M.(2000) Extending the concept of awareness to include static and dynamic person information, ACM SIGGROUP Bulletin, v.21 n.3, p.59-62, December 2000 http://delivery.acm.org/10.1145/610000/605657/p59-danis.pdf?key1=605657&key2=8876536801&coll=GUIDE&dl=ACM&CFID=22107544&CFTOKEN=87860324 Kirschner, P.A., Martens, R.L., Strijbos, J.W. (2004). CSCL in higher education? A framework for Designing multiple Collaborative Environments. In: Strijbos, J.W., Kirschner, P.A., Martens, R.L. What We Know About CSCL and Implementing It In Higher Education. Dordrecht: Kluwer Academic Publishers. Kreijns, K., Kirschner, P.A. (2004). Designing sociable CSCL environments. Applying interaction design principles. In: In: Strijbos, J.W., Kirschner, P.A., Martens, R.L. What We Know About CSCL and Implementing It In Higher Education. Dordrecht: Kluwer Academic Publishers. Nurmela, K., Palonen, T., Lehtinen, E., Hakkarainen, K. (2003). Developing

tools for analysing CSCL process. Preece, J. (2000). Online communities. Designing usability, supporting sociability. Chicester: John Wiley & Sons. Wenger, E. (1999). Communities of practice. Learning, meaning and identity. Cambridge: Cambridge University Press.

Related patterns

Making online learners trust each other

More information on relations

Author(s)

Ellen Rusman Open University of the Netherlands ellen.rusman@ou.nl

Type

Generic

Submitted date

2004-06-17

Support identifiable types of communication

Belongs to SIG
Collaborative learning

Maturity level


Category
not available yet

Problem
People don't understand each other, there's a low group cohesion, people have different expectations and people have a feeling of talking along each other while collaborating mainly text-based online.

Analysis
While trying to reach agreement on the solution of a problem and at the same time maintaining group cohesion, several types of communication are necessary. A broad distinction can be made between socio-emotional and task related communication (Bales in Underwood, 2003). Social-emotional communication can be positive as well as negative and task-related communication can be related to giving as well as asking for information at a functional as well as an operational level of activity.

Positive social-emotional communication is related to showing solidarity (e.g. raising other's status, giving help, reward), tension release (jokes, laughs, shows satisfaction) and agreement (passive acceptance, understands, concurs, complies). Negative social-emotional communication is related to disagreement (passive rejection, formality, withholding of help), showing of tension (ask for help, withdraws out of field and antagonism (deflates ones status, defends or asserts self).

The functional level of task performance is oriented to specific, conscious goals in the context of motives. It includes organisational, planning and problem-solving processes. The operational level is oriented to the practical conditions of the actions (Heeren & Lewis, 1997).

In both functional levels it includes giving and asking information. Giving includes giving a suggestion (direction, implying autonomy of other), opinion (evaluation, analysis, expression of feeling, wish), orientation (information, repeats, clarifies, confirms).
Asking includes asking for an orientation (information, repetition, confirmation), opinion (evaluation, analysis, expression of feeling), suggestion (direction, possible ways of action).

So, there are different functional levels and types of communication and by communicating online in most cases communication switches between them. Practice

teaches us that language usage also changes along with time and group cohesion: in most cases it becomes more informal, personal and emotional (Oren e.a., 2002).
Also ‘social-talk’ seems to improve group cohesion and interaction. So language usage and type of communication seems important for human interaction and the feeling of group cohesion.

To improve group cohesion and goal-related interaction it seems important to support all these types of interactions and levels of human activity. Interaction could benefit if people instantly know what type of communication they can expect or how they should interprete communication, avoiding misconceptions and offering possibilities to express more clearly what they meant with a certain remark.

To distinguish between types and levels of communications, it’s possible to contextualize or to label the communication.

With contextualisation, communication can take place in a special place meant to hold a certain type of communication (e.g. a cyber cafe for ‘social talk’, a work center to ‘make things’, an appointment center to ‘organize, structure, make appointments) or can be related to a certain instrument or object (e.g. agenda, a concept map).

With labeling, people add an extra clue for others how to interprete their remarks. It’s a kind of meta-data about their communication. Labeling can be done in different ways: by naming (semantically-based, e.g. ‘question’, ‘answer’, ‘suggestion’) or by visualizing certain types or functional levels of communication (e.g. ‘smilies’/’funny faces’, ‘question mark’).

Solution

Make task-related and socio-emotional communication more easy interpretable by providing identificational information through contextualisation and labeling. To support collaboration both types of communication ideally should be supported in a collaborative environment.

Known uses

Examples of contextualisation:

Through places (see figure, Monash University, 2003: student corner’ for news and social talk next to more workrelated places)

Through relation with an instrument/object (see figure, Brightsuite)

Examples of labeling

Textbased (Future Learning Environment FLE: meta-communication about communication through ‘tagging’ of notes, a combination of textbased and visual clues (colours))

Visualisation:
POLARIS (figure): visualisation of type of communication through icons, e.g. ‘?’ or ‘!’ etc. When hovering over icon text is provided as well)

IKANO communications 2004 (figure), use of emoticons to support text based communication)

Context

Design considerations for environments supporting task-related and socio-emotional synchronous and asynchronous text-based communication. The pattern is meant for designers of collaborative environments.

The characteristics of communication mentioned in the analysis section are general: they also apply to face to face situations. In these situations underlying meaning of communication is supported by ‘the setting’ people are communicating in, their body language and facial expressions and the artefacts they are working with and which can be seen directly. These supports are not automatically available in online settings and need to be designed for (Gutwin & Greenberg, 1998).

References

Brightsuite. http://www.dcasoft.com/BSpromo2/emeeting2.htm

Dillenbourg, P. (1999). Collaborative learning, cognitive and computational approaches. Oxford: Elsevier science.

Future learning environment, Fle3.[Available online]: http://fle3.uiah.fi/index.html

Gutwin, C., Greenberg, S (1998). Design for individuals, design for groups: tradeoffs between power and workspace awareness. Proceedings of the 1998 ACM conference on Computer supported cooperative work. [Available online]: http://delivery.acm.org/10.1145/290000/289495/p207-gutwin.pdf?key1=289495&key2=3761992901&coll=GUIDE&dl=GUIDE&CFID=26004208&CFTOKEN=17977420 .

Heeren, E., & Lewis, R. (1997). Selecting communication media for distributed communities. Journal of Computer Assisted Learning, 13(2), 85-98.

IKANO communications (2004). FAQ for Vista. [Available online]: http://www.netfaqs.com/windows/Chat/Vista/Chat/

Monash University (2003). Online student resource center. Language and learning services unit. [available online]: http://www.monash.edu.au/lls/sif/sif.htm

Oren, A., Mioduser, D., Nachmias, R..(2002). The development of social climate in virtual learning discussion groups. [Available online]: www.e-

learningplaza.nl/artikel/show_art.asp?nr=316 .

POLARIS, Learning Lab Maastricht. [available online]: http://www.ll.unimaas.nl/polaris/index_english.htm

Underwood, Mick (2003). Group dynamics. [Available online]: www.cultsock.ndirect.co.uk/MUHome/cshtml/groups/groups4.html

Underwood, Mick (2003). Bales' interaction process analysis. [Available online]: www.cultsock.ndirect.co.uk/MUHome/cshtml/popups/bales1.html

Woolley, D. (updated July 10th, 2004). Collaborative Work Environments: An independent guide to online collaborative workspaces for virtual teams and e-learning groups. [Available online]: http://www.thinkofit.com/webconf/workspaces.htm

Related patterns

More information on relations

Author(s)

Ellen Rusman, Open University of the Netherlands

Type

Domain specific

Submitted date

2004-09-08

Collaborative Awareness

Maturity level

Category:
CSCL

Abstract:
Collaborative tele-learning emphasizes collaborative interaction in online learning communities in-between students and facilitators. The nature of the distribution puts an heavy load on coordinating the interaction between learners (e.g working in teams),and between learners and facilitators (teachers etc).Mechanisms to support the coordination work on behalf on the students and mediate the interaction are needed to lessen this load. This can be done by designing mechanisms that keep an overview of what happens and report (and support) back to the students. Incorporated into these mechanisms there should also be guidelines about how knowledge building communities best flourish, scaffolding interaction, creating and encouraging for richer interactions and opportunities for learning.

Problem:
Students have difficulties in following and structuring an cohesive joint effort/interaction on learning tasks when working collaboratively in distributed teams. This often lead to little activity, scattered contributions, alienation, and students feeling they are wasting their online time.

Analysis:
Collaborative telelearning emphasizes the collaborative interaction in online learning communities in and between students and facilitators. By following Salomon's (1992) recommendations, collaborative learning environments should be designed to encourage mindful engagement (voluntary expenditure of task related mental effort) among the participants through genuine interdependence.
Genuine interdependence is characterized by Salomon as the necessity to share information, a division of labor and the need for joint thinking. In such settings there is a need for monitoring and facilitating this kind of organisation (Wasson,1998,p.280).
These guidelines are great but we often see that students have difficulties in following and structuring joint cohesive interaction on learning tasks when working collaboratively in distributed teams. This often leads to alienation, and high dropouts rates in e-learning programs. Another major problem is scattered efforts and little persistent cohesive activity along with unwanted group effects like 'ganging upon the task' and the 'sucker effect' (Salomon Globerson,1989).
The complexity in collaborative telelearning scenarios can roughly be seen from two different points of view. From the instructor's view, collaborative telelearning is hard to monitor and facilitate. It is difficult to notice when a point of genuine activity occurs

(e.g.when the students are online working or not) and progression is often not streamlined due to different timetables, local culture, and the individual student's personal preferences. From a student's perspective, it is also difficult to coordinate and align joint collaborate activities due to much of the similar problems. The problems of coordinating the distributed learning activities often require a "tremendous" effort on the students and the facilitators. The challenge is to move some of this "burden" from humans to ICT based artifacts.

Known solutions:
Make mechanisms that provide 'collaborative awareness'. The collaborative awareness mechanisms should monitor what goes on and give sound advices for how to collaborate in e-learning. There have been a large amount of research within synchronous groupware systems on collaborative awareness (e.g Greenberg &Roseman,1996),but little research on how to provide asynchronous collaborative awareness.
Awareness mechanisms in asynchronous e-learning systems should keep track of what is going on in the student's virtual environment (assignments, news, messages, collaborative task progress etc.), and in this way support and strengthen the necessary interdependencies between actors in e-learning environments.
Instead of just letting the learner know that something has happened, these mechanisms should also provide awareness information about what and who did what, and then give advice build on sound pedagogical knowledge. For instance if you are using a discussion group you should also incorporate awareness mechanisms that notify the discussants about what goes on. In particular a learner should know when someone has replied to one of her/his own postings, but also when someone has not replied to a posting and then urging the participants to reply to each others postings so the interaction do not stop (see figure below for an example of an advice given that also provide awareness information about a posting being left alone).

[Figure 1: Showing an advice given to learners in a discussing group containing awareness information]

This is a design pattern grown out of InterMedia experiences with how collaborative learning should be supported in distributed settings. In this work we have been using FLE3 (see http://fle3.uiah.fi) and developed our own extensions (various assistants and agents) to support both teachers and students.

Research questions:
How should sound advices and wisdom about collaboration be incorporated into the awareness mechanisms?
How to avoid information overload?
How to configure the mechanism?

Context/conditions:
This pattern is particular pertinent to situations where there are non or few face-to-face meetings, or in situations where there are loose relationships between the learners, and also applicable in settings where the learners are considered novices in e-learning.

References

S.Greenberg and .Roseman.Groupware toolkits for synchronous work.Technical Report 96-589-09,
Department of Computer Science,University of Calgary,1996
Salomon,G.&Globerson,T.(1989)When teams do not function the way they ought to.International journal
of Educational research.,13 (1),89-100.
Salomon,G (1992).What does the design of effective CSCL require and how do we study its effects?SIGCUE
Outlook,Special Issue on CSCL,21(3),62-68.
Wasson,B.(1998).Identifying Coordination Agents for Collaborative Telelearning.In International Journal of
Artificial Intelligence in Education,9,pp.275-299.

Related patterns:

Personalisation
Virtual Assistant

Author (s):

Rune Baggetun

Date:

24.02.2004

Acknowledgements:

Weiqin Chen,Barbara Wasson,Steinar Dragsnes,Anders ørch,Simos Retalis,Christiana Nicolaou

How to keep participants in CSCL motivated

Maturity level

Category:
pedagogical

Abstract:
Motivation of participants is crucial especially in CSCL or collaborative work environments, where loss of motivation causes waste of time, passiveness, and inefficiency. Motivation may be increased among remote participants by clever use of interaction and competition dynamics, creating engagement and strengthening ties within groups.

Problem:
A common problem in distributed collaborative working environments is the lack of motivation in participants. While meeting face-to-face is often a sufficient stimulus to work, people tend to loose motivation in distributed situations.

Analysis:
Keeping motivation alive is crucial for active and effective collaboration. Motivated participants are more likely to find the way of overcoming obstacles and work efficiently to achieve their goals.
However, CSCL lacks the motivation that is given simply by the physical presence of other participants. Besides, coordinating work among distributed participants is often difficult: this contributes to lessen motivation.

Known solutions:
- make sure that everyone knows what to do and how to do it
- fix precise deadlines
- encourage social interaction among participants, so that they know better who they are collaborating with, and collaboration becomes more natural
- use interaction and competition dynamics to increase motivation (e.g. if students are supposed to study and learn a certain set of information, make tests object of a playful competition among teams of distributed participants, such as some quiz game, possibly to be held synchronously on a fixed date)
- encourage collaboration among participants (if any) who also share their physical context (collaboration in presence is usually more effective)

Research questions:
Two causes for loss of motivation are listed here; are there any others?
Is face-to-face collaboration intrinsically more motivating than collaboration among remote peers?

Context / Conditions

Collaboration among distributed participants, possibly coordinated and structured by a single subject (e.g. the provider of an online course) who plans activities, assigns deadlines, and coordinates interaction.

Author : Caterina Poggi

Date: 19.01.03

Demographic Data

Belongs to SIG

Adaptive learning

Maturity level

Category

not available yet

Problem

What information should be included as demographic data in a user model that is to be used in an Adaptive Web-based Educational System (AWES)?

Analysis

There are some pieces of information that are “objective facts” about a user, e.g. age, education) and are somewhat important for the adaptation. For example the education of a user is important if s/he registers into a training course.

The demographic data can not be automatically extracted from the user interaction but they can only be provided directly from the user since they are personal objective data.

The demographic data usually remain the same during the whole period of interaction of the user with the system. However, it should be possible that the user can update them, should any such data happen to change, e.g. the user changes address or telephone number.

Solution

The information that has to be kept as demographic data should generally be comprised of the following:

- identification data (e.g., name, address, phone number),
- geographic data (area code, city, state, country),
- personal data (e.g., age, sex, education, profession, income),
- extra-curricular data (e.g. hobbies, tastes, lifestyle).

User should be notified that their personal data will not be used for purposes other than the actual adaptation of the learning environment. The process of filling the data by the user should be preferably performed through a secure connection (e.g. the HTTP Secure Socket Layer). The demographic data should be collected through questionnaires in the USER MODEL INITIALIZATION phase, before the user starts interacting with the learning material. However, the user should have the ability to change them during the learning period by using the USER MODEL MAINTENANCE components.

Known uses

Demographic data are met not only in most AWES, but also in most commercial web sites that provide customized content through the personalization of the website. For

example on-line book stores collect such data from users through on-line questionnaires so that they serve the users content of interest to them (favorite authors, favorite themes).

Context

References

Related patterns
User Model Definition

More information on relations

Author(s)
Tzanavari, A., Avgeriou, P. and Vogiatzis, D.

Type
Domain specific

Submitted date
2004-09-14

User Goals

Belongs to SIG
Adaptive learning

Maturity level


Category
not available yet

Problem
What information should be considered as user goals in a user model that is to be used in an Adaptive Web-based Educational System (AWES)?

Analysis
• Being able to model the user/learner's educational goal(s) can facilitate adaptation. An AWES (via its author) can "deliver" the same course differently to learners with different educational goals, by setting the appropriate conditions to meet those goals. For example a learner with a goal "to master subject X" will receive more in-depth tutoring than a learner with a goal "to familiarize themselves with subject X".
• It is incorrect to assume that all users/learners aim at learning all of the material offered by an AWES.
• Educational goals can vary in scope. For example they may refer to the whole duration of the course, or to only a part of it.
• There are some types of user goals that can be determined by the users, but some others cannot. For example, the users can determine the initial educational goal before starting a course using the AWES, but probably cannot be in a position to set the best (short-term) goal(s) for themselves while the course is in progress.
• The user goals determined may be in a form that is not suitable to be directly included in a user model.

Solution
Include specific user goals in the user model in order to facilitate adaptation, and capture the real intent of the learner with respect to the learning material. The information that has to be kept as user goals in order for the system to better adapt to its user, is divided in two categories:
• Long-term goals - educational goals that are valid for a longer period of time and require significant effort to be met.
• Short-term goals – educational goals that are valid for a shorter period of time and require relatively moderate effort to be met.
Long-term goals are usually determined by the users, whereas short-term goals by the AWES that plays the role of a tutor and is driven by the course author. In the second case, a goal-modelling component may be required: a component that will take relevant data (frequently USER KNOWLEDGE), process it and derive goals.

In order for particular user goals to be included in a user's model, a pre-processing operation may be necessary to bring them to the required format that was defined by the USER MODEL REPRESENTATION.

Known uses

Interbook [1] initially modelled an educational goal as a sequence of sets of concepts, while later on as a stack of sets, allowing the user to move a selected goal to the top of the stack. BGP-MS [2] models the user's goals in multiple ways. Firstly, the developer of BGP-MS applications can specify groups of users that share common goals. In addition, s/he is able to specify the user goals that correspond to specific answers to a questionnaire, as well as to specify the user goals that correspond to specific user actions as they are observed by the system.

Context

You have designed the USER MODEL DESCRIPTION as part of the USER MODEL COMPONENT of an AWES and have decided to include USER GOALS. You are currently reflecting on what to consider as USER GOALS.

References

[1] Brusilovsky, P., Eklund, J. and Schwarz, E. (1998). Web-based education for all: A tool for developing adaptive courseware. Computer Networks and ISDN Systems, 30(1-7), 1998, 291-300.

[2] Kobsa, A., Müller, D. and Nill, A. KN-AHS: An adaptive hypertext client of the user modelling system BGP-MS. Proc. UM 1994, 31-36.

Related patterns

User Model Definition

More information on relations

Author(s)

P. Avgeriou, D. Vogiatzis, A. Tzanavari and S. Retalis

Type

Domain specific

Submitted date

2004-09-14

User Model Definition

Belongs to SIG
Adaptive learning

Maturity level


Category
not available yet

Problem
In a traditional educational setting, an instructor is considered "a good one" when (s)he can get most out of her/his students individually, that is, taking into account different learning styles and needs. When the instructor's role is to be played by an educational hypermedia system, then ignoring the learner's individuality, limits the system's ability to offer her/him an effective learning experience. Therefore, the system's adaptation to individual learning-related characteristics, is essential.

What information should an Adaptive Hypermedia Educational System keep for the user in order to offer him/her the best possible learning experience?

Analysis
A user model is essentially the "image" the system has about the user; the information it holds to describe him/her. An adaptive educational hypermedia system enriches its functionality by maintaining a user model and providing mechanisms to modify application features based on that. Modifications can be related to the organizational and presentational issues of the learning resources permission to continue or not, encouragement to read specific sections, undertake some tasks, move to a higher difficulty level etc., resulting in a personalized instruction. The closer the user model is to the user's real characteristics and needs, the better the personalization. Therefore, the information kept in the user model has to be such that it describes the user/learner in the best way possible, but at the same time allows the model to be flexible in its manipulation.

Standardisation of the user model is an important issue, because through this we can greatly enhance the user model's portability, as well as the interoperability of AHES that utilize such descriptions of learners. This will allow users to use several different AHES and "carry" their personal model with them, providing the systems with the same "image" of themselves, without that leading to compatibility problems. Attempts to standardize the user/learner model that should be taken into account are the IEEE Personal and Private Information, PAPI, [IEEE PAPI] and the IMS Learner Information Package, LIP [IMS LIP]. The PAPI standard reflects ideas from intelligent tutoring systems where the performance information is considered as the most important information about a learner and also considers interpersonal relationships [Vassileva et al. 2002], whereas the LIP standard is based on the classical notion of a CV and

interpersonal relationships are not considered at all. Both get into too much detail and are thus hard to use. We need a user model that is smaller, more compact and more flexible.

Solution

A user in general is very complex to describe, meaning that theoretically, the information that would be needed to fully describe him/her (with great detail), would be too much for an application to handle, but also part of it would probably not be utilised. Consequently, a certain number of information items have to be carefully selected to form the user model. In an AHES setting, the items have to be directly related to the user as a learner – anything that would be considered useful to better adapt the learning experience to the learner's particular characteristics.

The IMS LIP and PAPI proposed standards for a learner model, include indeed several important attributes to describe the learner. However, one can observe that useful information that is missing from the first, can be found in the second or vice versa, or is missing from both. By closely looking at the two, we can identify the most useful elements and then enrich them with the necessary features to fill in the gaps.

As a result, a complete user model definition should generally be comprised of the following elements:

- Demographic data, which are relevant to the particular AHES (e.g. as age, gender, etc.)
- User goals, which are related to the long term and short term learning goals related to learning objectives of specific concepts to be learnt (e.g. "to complete course X")
- User preferences with respect to the various dimensions of the learning opportunity (e.g. the mode of delivery, accessibility requirements, or assessment)
- User knowledge, which includes the knowledge level about concepts to be learned and weaknesses and strengths on particular areas, sections or points of the concepts
- Usage data, which include information like which pages were viewed, in what order, etc.

The stereotype that applies to the user, which essentially is the group of users s/he belongs to based on some predefined presuppositions in terms of knowledge level, learning and cognitive styles (e.g. the "Novice User", the "Expert User", the "acoustic user", the "activist user" stereotypes etc.).
Note that the above list is not restricting – it merely intends to provide the more generic elements with respect to the description of a learner. Designers are encouraged to include other specific elements that would fit their custom AHES.

Known uses

Interbook [Brusilovsky et al. 1998] and BGP-MS [Kobsa et al. 1994] mainly base the user model on the user knowledge, usage data, user goals and stereotypes. ALE [Specht et al. 2002] also maintains information about usage data, including evaluation results, as well as user knowledge and goals. ISIS-Tutor [Brusilovsky & Pesin 1994] incorporates user knowledge and usage data and in ELM-ART II [Weber et al. 1997] the topics learned by a user are represented as values (from a controlled vocabulary) that are assigned to the systems' units.

Information kept in user models used by the I-Help [Bull et al. 2001] system includes: knowledge, interests, cognitive style, interaction preferences and user actions. In addition, the notion of a group (the one the user belongs to), is employed extensively. The personal learner assistant developed within the ELENA project [Dolog & Nejdl 2003] is using the proposed blended approach which is represented with a RDF schema [Dolog et al. 2003].

Context

References

[Brusilovsky et al. 1998] Brusilovsky, P., Eklund, J. and Schwarz, E. (1998) Web-based education for all: A tool for developing adaptive courseware. Computer Networks and ISDN Systems Vol. 30, Issue 1-7, pp. 291-300.

[Brusilovsky & Pesin 1994] Brusilovsky, P. and Pesin, L. ISIS-Tutor: An adaptive hypertext learning environment. JCKBSE'94, Japanese CIS Symposium on knowledge-based software engineering, Pereslavl-Zalesski, Russia, pp. 83-87, 1994.

[Bull et al. 2001] Bull, S., Greer, J., McCalla, G., Kettel, L. and Bowes, J. (2001) User Modelling in I-Help: What, Why, When and How. In: Proc. of User Modeling 2001. LNAI 2109, pp. 117-126.

[Dolog et al., 2003] Peter Dolog, Rita Gavriloaie, Wolfgang Nejdl, and Jan Brase. Integrating adaptive hypermedia techniques and open rdf-based environments. In Proc. of 12th International World Wide Web Conference, Budapest, Hungary, May 2003.

[Dolog & Nejdl 2003] Peter Dolog and Wolfgang Nejdl. Personalisation in Elena: How to cope with personalisation in distributed eLearning Networks. In Proceedings of the Conference on Worldwide Coherent Workforce, Satisfied Users - New Services For Scientific Information, Oldenburg, Germany, September 2003.

[Kobsa et al. 1994] Kobsa, A., Miiller, D. and Nill, A. (1994) KN-AHS: An adaptive hypertext client of the user modeling system BGP-MS. In: Proc. of User Modeling 1994, pp. 31-36.

[IEEE PAPI 2002] IEEE. IEEE P1484.2/D7, 2000-11-28. draft standard for learning technology. public and private information (papi) for learners (papi learner). Available at: http://edutool.com/papi/. Accessed on May 6, 2004.

[Specht et al 2002] Specht, M., Kravcik, M., Klemke, R., Pesin, L. and Hüttenhain, R. (2002) Adaptive Learning Environment for Teaching and Learning in WINDS. In: Proc. 2002 Conference on Adaptive Hypermedia and Adaptive Web Based Systems.

[IMS LIP 2002] IMS. IMS learner information package specification. Available at: http://www.imsproject.org/profiles/index.cfm. Accessed on: May 5, 2004.

[Vassileva et al, 2002] Julita Vassileva, Gordon McCalla, and Jim Greer. Multi-agent

multi-user modelling in I-Help. User Modeling and User-Adapted Interaction, 2002.

[Weber et al. 1997] Weber, G. and Specht M. (1997) User Modeling and Adaptive Navigation Support in WWW-Based Tutoring Systems. In: Proc. of User Modeling 1997.

Related patterns

More information on relations

Author(s)
D. Vogiatzis, A. Tzanavari, S. Retalis, P. Avgeriou and A. Papasalouros

Type
Domain specific

Submitted date
2004-09-14

User Model Initialisation

Belongs to SIG
Adaptive learning

Maturity level


Category
not available yet

Problem
Before all interaction, the Adaptive Hypermedia Educational System initialises the user model.

What is the minimum amount of information needed, to kick start the system? What kind of information and what amount is the user capable or willing to provide?

Analysis
Not all elements of the User Model definition have to be acquired in order for the user to start interacting with the AHES. There are two reasons for that. In the beginning of an interaction session, users do not like spending a lot of time providing information about them, answering long questionnaires for instance. Second, it is not necessary to have a complete model of the user; a partial model (with proper selection of a subset of UM elements) will be acceptable.

There are UM elements that can be acquired directly from the user and data that can be acquired through the AHES. For instance, demographic data can only be provided by the user. On the other hand, user knowledge can also be derived by the system e.g. via the prehistory of user's learning activities in other educational environments.

It is also important to initialise the user stereotype, because according to the various groups of users based on their stereotypes the learning tasks will be specified for each group separately.

There are two options for the UM, it will be identified with certainty, or it will be speculated. The first option is not usually the case in practical AHES systems.

Solution
The AHES designer should create fill-in forms with questions that refer to a desired subset of UM elements. The desired subset is required to form an initial view of the user model so as to kick start the AHES. There are a number of ways whereby the desired elements can be derived. Below we provide a list of plausible choices stemming from real AHES systems that a designer should take into account.

The desired UM elements could be obtained explicitly, by presenting to the user a

questionnaire, which s/he has to fill in. Typically, the user provides data, such as demographic data, user preferences, and possibly other sorts of data that are compatible with the user model description specification.

Another option is to assume values for the desired UM elements from previous training sessions/learning activities of the user. For instance, a user having followed the prerequisites of the current course is considered to have enough knowledge to follow it.

Yet another option is to assume certain values with nothing to backup this choice apart from being plausible for the desired UM elements, and then to proceed with the interaction, expecting that the user model will be corrected during the running time of the AHES. This is essentially a trial and error approach.

Deriving the applicable stereotype requires that a minimum amount of knowledge and specifically a minimum number of user model definition elements is available. The derivation of the applicable stereotype can be performed in a number of ways.

The following list is to be considered as indicative rather than complete:

- It can be user driven
  For instance the user specifies explicitly that (s)he belongs to the novices' stereotype
- Inferred by rules
- Stereotypes are equipped with triggers, which activate them.
- Rules tell which UM elements and with what values can activate a stereotype.
- Speculated by rules
  If it is the case that there is absolutely no information which can suggest a certain stereotype, then the AHES designer should have some rules to allow selection of the stereotype. For instance, a rule of this kind might be: if user does not specify his/her knowledge level, then assume it is average.

Known uses

In INSPIRE [Grigoriadou et al. 2001] the user model is initialised, through a questionnaire filled in by the user at the beginning, or by explicitly selecting the category s/he fits in according to some general characteristics. ELM-ART II [Weber et al. 1997], requests from the users to declare knowledge units, which are already known to them. In DCG [Vassileva 1997], the user model, called student model, is initialized with a preliminary test. ACE [Specht et al. 2000] follows a somewhat mixed approach. The user model is initialised by explicit and implicit elicitation from the users. The former is performed, by the user, which specifies her/his learning strategy and stereotype; whereas the latter is done by a dynamically generated test.

Context

References

[Grigoriadou et al. 2001] Grigoriadou, M., Papanikolaou, K., Kornilakis, H. and Magoulas, G. (2001). INSPIRE: An Intelligent System for Personalized Instruction in a Remote Environment. In: Proc. of the 3rd Workshop on Adaptive Hypertext and

Hypermedia, in User Modeling 2001, LNCS, Springer

[Specht et al. 2000] Specht, M., Oppermann, R. (2000) ACE: Adaptive Courseware Environment, Lecture Notes in Computer Science, Vol. 1892

[Vassileva. 1997] Vassileva J. Dynamic Courseware Generation, Communication and Information Technologies, Vol. 5, Issue 2, pp. 87-102

[Weber et al. 1997] Weber, G. and Specht M. (1997) User Modeling and Adaptive Navigation Support in WWW-Based Tutoring Systems. In: Proc. of User Modeling 1997.

Related patterns

User Model Definition

More information on relations

Author(s)

D. Vogiatzis, A. Tzanavari, S. Retalis, P. Avgeriou and A. Papasalouros

Type

Domain specific

Submitted date

2004-09-14

User Model Maintenance

Belongs to SIG
Adaptive learning

Maturity level


Category
not available yet

Problem
During the course of interaction, many things about the user are changed, e.g. assumed user knowledge, usage data etc. Thus, the user model must be adapted to the new realities. After all, the first letter in AHES stands for Adaptive.

How should the system capture those changes so as to maintain a good user model?

Analysis
The assumption that the user model will remain the same as when it was acquired originally is in most cases incorrect. As in tutoring between a human tutor and a student, where the student constantly demonstrates changes, the user of an AHES also changes and as a result his/her model has to reflect this. During the course of interaction, leverage of user knowledge develops and the usage data builds up. Since the adaptation is to a large extent based on user knowledge and usage data, changes should definitely be recorded and be related to a “cause / result”.

In fact, information such as “demographic data” does not change with a high frequency. There is also, information like “topics covered”, part of user knowledge effect if the system is to function effectively that changes continuously.

It is also important for users to be in control, to a degree acceptable to the AHES, of their model for several reasons. They need to be able to modify information in their model if they feel that it is inaccurate or incorrect. Also, being in control, builds up their trust in the system.

Solution
The maintenance of an accurate User Model, UM, can be user driven or system driven. In the former case it is the user who provides explicit information about changes in his/her UM. In the latter case, the AHES derives information by closely watching the user.

The AHES designer should define the conditions that govern the maintenance of the user model. In particular the designer should define the scope of the maintenance changes. The scope defines the reason for updates. The reason is then quantified in terms of choice of elements to undergo change. For instance, if the scope says that only a minimal update of the user knowledge is going to occur, then choice of elements is bound to user

knowledge only. On the other hand a wider choice for the scope would allow updates of user knowledge and user preferences e.g. to read theory and having links to examples. Finally, the frequency of UM description elements updates should be defined.

The UM maintenance module elicits data to update the UM description. Elicitation of data could take many forms; next we provide some characteristic examples. The user is presented with a form to fill in, whereby the update UM is derived. UM description update can also be interactive, when the AHES opens for instance a pop-up form requesting the user to explicitly answer a question. Finally, another option for UM update is through filtering the stream of data that are produced through user interaction. A typical example is the browsing strategy which can be reduced to a small number of primitives, like 'ringiness' (a route that returns to the start node), 'spikiness' (a route with a return path retracing the original path), 'loopiness' (a ring that contains no other rings), 'pathiness' (a route that does not visit any node twice) [Canter et al., 1985]. The raw data constitute the actual path that the user has followed, but they must be filtered, processed or summarized to be translated to the predefined number of primitives.

Known uses

In [Grigoriadou et al. 2001] there is an Interaction Monitoring Module, which collects information and updates the learner model accordingly. The system allows the users to intervene, expressing their perspective. A similar approach is followed in [Weber et al. 1997], where the update of the user model is driven by the system. It is also possible to inspect and to edit the user model. Yet another similar approach is followed in [Vassileva 1997]. Student model changes are performed according to student progress. Students can also explicitly modify their Personal Traits and Preferences. In [Specht et al. 2000] there is a diagnostic module for automated updates of the user module. Learners can also modify their model anytime.

Context

References

[Canter et al., 1985] Canter, David, Rivers, Rod, and Storrs, Graham. Characterizing user navigation through complex structures. In Behavior and Information Technology, 4(2), 93-102.

[Grigoriadou et al. 2001] Grigoriadou, M., Papanikolaou, K., Kornilakis, H. and Magoulas, G. (2001). INSPIRE: An Intelligent System for Personalized Instruction in a Remote Environment. In: Proc. of the 3rd Workshop on Adaptive Hypertext and Hypermedia, in User Modeling 2001, LNCS, Springer

[Specht et al. 2000] Specht, M., Oppermann, R. (2000) ACE: Adaptive Courseware Environment, Lecture Notes in Computer Science, Vol. 1892

[Vassileva. 1997] Vassileva J. Dynamic Courseware Generation, Communication and Information Technologies, Vol. 5, Issue 2, pp. 87-102

[Weber et al. 1997] Weber, G. and Specht M. (1997) User Modeling and Adaptive Navigation Support in WWW-Based Tutoring Systems. In: Proc. of User Modeling 1997.

Related patterns

User Model Definition
User Model Initialisation

More information on relations

Author(s)

D. Vogiatzis, A. Tzanavari, S. Retalis, P. Avgeriou and A. Papasalouros

Type

Domain specific

Submitted date

2004-09-14

User Preferences

Belongs to SIG

Adaptive learning

Maturity level

Category

not available yet

Problem

What information should be included as user preferences in a user model that is to be used in an Adaptive Web-based Educational System (AWES)?

Analysis

If instruction is not aimed at the users' learning style, then noϖ significant difference over traditional (non-adaptive systems) can be observed.

It is highly desirable for an AWES to "predict" (some) of the user'sϖ preferences.

Different learners prefer different assessment methods.

There are some aspects of the user's preferences that cannot be potentially included in the AWES and yet they capture user traits. For instance, environmental and emotional stimuli even if they could be captured, it is not clear how they would be used to adapt AWES.

Solution

User preferences is an element of the user model that captures learning style, user interests, preferred method of assessment, etc. User preferences is a user modeling parameter that (generally speaking) cannot be deduced from the AWES, but has to be provided by the user.

The learningϖ style in an AWES is the way various elements of the physical stimuli affect the user's ability to absorb and retain information, values, facts or concepts. Hence, the learner's chances of doing well in a system that accommodates various learning styles would appear to be significantly better than in one with a single method of delivery. Among the learning styles that have been used, we mention the following possible choices:

- Visual Interactive: Where the user is taught a subject by interacting with the AWES to grasp concepts with experience.
- Auditory - text style: Concepts seen on the screen (in text form, for instance) are also delivered in auditory form.
- Auditory – Lecture Style: It concerns recorded lectures in traditional classrooms.
- Text – Style: This applies to people who feel more comfortable with a text book.
- Users can choose their assessment method, possible choices being: multiple choice questions, quizzes etc.
- Other settings: preferences for language, interface settings, personal annotations etc. facilitate the learning experience.

- Users can directly determine their preferred subjects, butϖ also it is possible for the system to infer the potential subjects of interest by considering the history of a user's selections.
  In order for particular user preferences to be included in a user's model, a pre-processing operation may be necessary to bring them to the required format that was defined when the USER MODEL REPRESENTATION was designed.

Known uses

In ACE [1] there is a default teaching strategy for each learning module, but learners can also change the teaching strategy (it is possible to select between learning by example, reading text etc). Ace also holds information about interface settings and users' preferred subjects. Arthur [2] uses the metaphor of multiple instuctors (each with a different teaching style) for the same subject. Subjects are divided into modules and users have a multiplicity of instruction methods for each module.

Context

References

[1] Specht, M., Oppermann, R. (2000) ACE: Adaptive Courseware Environment, Lecture Notes in Computer Science, Vol. 1892.

[2] Gilbert, J. and Han C.Y. (1999) Adapting Instruction in Search of "A Significant Difference". Journal of Computer and Network Applications, Vol. 22, pp. 149-160.

Related patterns

User Model Definition

More information on relations

Author(s)

Tzanavari, A., Avgeriou, P. and Vogiatzis, D.

Type

Domain specific

Submitted date

2004-09-14

Scripted Collaboration

Maturity level

Abstract:
Scripted collaboration is seen as a remedy for situations where the forming of groups does not lead to collaboration and learning by itself. A script can be seen as description of a distribution of tasks between group members to structure the interactions in order to make the probabilities/opportunities for collaborate learning higher.
Problem: In many online courses instructors are faced with the fact that collaborative learning just does not happen even though students are grouped together in teams and get a task to work on. Cooperation (rather than collaboration) and other 'unfortunate' effects are frequently observed (see e.g Salomon & Globerson,1989) instead of genuine collaborate learning.

Analysis:
Collaborative learning is seen as a pedagogical solution where members in a group form a distributed cognitive system in which they jointly solve a task drawing on the resources and interactions in the group. Putting a group of students together is in many cases not enough in order for collaborate learning to take place. The discussion on cooperation vs. collaborations, and various studies (e.g. Salomon &Globerson,1989) have shown that collaborate learning does not just happened. Further it is mainly through the process of grounding (coming to a shared understanding) collaborate learning happens. A grounding process can occur through conflict resolution, argumentation, negotiation, explanation, or through mutual regulation in a group. This can be facilitated by designing scripts where one design for conflict resolution, argumentation, negotiation, explanation, or through mutual regulation tasks to happen, and where the learning results from compensating the 'drawbacks' of the task distribution and interactions .
With scripts you can structure what is sometimes difficult by group self regulation, you can script certain scenarios or design a setting according to how you want the tasks and information/knowledge should be distributed in order to accomplish a certain effect (e.g. conflict resolution).This is a more optimal distribution than by chance, because it is a proven distribution that have yielded proven learning outcomes/effects.

According to Dillenbourg (2004)a CSCL script is a sequence of phases. Each phase is defined by a deadline, a deliverable and system input. A set of roles (e.g unspecified, complementary (JIGSAW), hierarchical).They could be fixed or rotating. Multiple social planes (solo, group, collective), and different communication modes at different plane. Last, data flow between planes and phases should be specified.

Solution:
Make a system where computational mechanisms automates the rationale in the script (e.g. Identify conflicting views among participants for later forming of groups as in the

ArguGRAPH script). Make the script explicit with regard to the various tasks, phases, roles, social level configuration, and dataflow between the phases.
Known examples: The Grid Script (see) The ArguGRAPH script (see)
See http://craftsrv1.epfl.ch/mosil/htdocs/files.html for a selection of CSCL scripts.

References:

Salomon, G. & Globerson, T. (1989) When teams do not function the way they ought to. International journal
of Educational research., 13 (1), 89-100.

Author:
Rune Baggetun

Date:
2/6/2004

Forming groups for group work within a classroom context

Maturity level

Category
Pedagogical/ organizational

Abstract
Aspects to take into account when forming small groups within an existing class for group work, for instance to work on an assignment or perform a project. The assignment or project will last for a limited period differing from an hour to some weeks, but start and end will be clear from the moment the group has been formed.

Problem
How can a small group to work on an assignment or project be formed?

Analysis
When you want to introduce group work (one way to make students or learners interact and cooperate within your classroom), you have to be aware of several choices to make when forming groups in order to make interaction as fruitful as possible. If you want to form groups for group work you'll have to:

- decide who forms the group; the participants themselves or the teacher;
- decide what sort of group you want to form (informal, formal or base, heterogeneous or homogenous);
- decide on group size.

These aspects have effect on positive interdependence and the creation of commitment and therefore the successfulness of the group to reach their goals (for instance to write a report or give a presentation). You can also make choices concerning the procedure to follow to form the groups.

Known solutions
Who forms the group:
If you allow the students to form the groups themselves, they often cluster with friends. Important factor then is that the group members know and trust each other and are probably more able to discuss equal participation. But also in this context it is important that a coach monitors each participant's contributions and role-taking. Difficulties can arise if somebody not belonging to the already existing cluster joins; (s)he may feel left out.

Sort of group:
Informal groups exist only shortly, for example during a meeting when one is asked to discuss something within the context of for example a lecture with ones neighbor(s), who

can be someone else every other day. *Formal groups* exist during a certain period and have a better defined goal to reach (for instance an assignment of project to accomplish) which needs more structure. *Base groups* resemble formal groups but last even longer then a project; members are chosen for their specific experience and the strength enhances as longer as the group exists. *Homogenous groups* are most likely to exist within a classroom, in which the students resemble the amount of prior knowledge, goal(s) to reach, age and (life) experience. Also previously acquired social skills to communicate and collaborate within the group are aspects to take into account. Differences in these make the group more *heterogeneous*. Within the context of group work both informal and formal groups will exist. Base groups and heterogeneous groups (as opposed to homogeneous groups) will not often be formed for short-lasting assignments or project. One aspect which is not yet discussed is roles and tasks and goals to reach for groups as these. These will be discussed in the DP on aspects to take into account when organizing project centered learning.

Procedures to form the groups:
A way to form groups is simply to select the first students on an alphabetical ordered list. Doing so, you will probably combine male and female students, friends and non-friends. An other way is to make them draw numbers from a box (as many numbers as you want groups to emerge) and join the numbers one, numbers two, etc. Within an educational context most times information is available on the (probably similar) background of students or participants in a course. This enables the instructor to guarantee the heterogeneity.
A third way to form groups is related to (differing) topics or themes each group is supposed to work on. Students then select a group based on the topic. Of course one should be aware of the above mentioned risks if the students themselves select the group (and thus the group members).

Group size:
The group has to be small enough to give everybody the opportunity to participate and prevent participants to hide. It should also be small enough to prevent the group of losing time to come cohesive and structure and schedule. On the other hand the group has to be large enough to provide sufficient diversity of opinions and backgrounds as well as resources to get the job done. Group size is connected to the character or sort of the group. The more informal and short-lasting the group, the smaller it should be. Depending on the goal and the existence of the group, which in this DP is t perform group work, the ideal size is 4 to 6 students. More informal groups should even be smaller. Group size for groups brought together to collaboratively build knowledge or form a community of practice will be larger.

Research questions
Information is still needed on how to monitor and coach groups. An aspect which needs further research too is how to support groups to optimally function (for instance by providing tools to interact, how to train them and how to design good projects or assignments).

Conditions
Critical success factors:
◊ The need to depend on each other (complexity of task)
◊ Coach to monitor the process of working and learning together (tutor or teacher)
◊ Trust between group members

Discussion / consequences

References
Cooper, J., Prescott, S., Cook, L., Smith, L., Mueck, R., and Cuseo, J. (1990). *Cooperative learning and college instruction: Effective use of student learning teams.* California State University Foundation, Long Beach, CA.
Fiechtner, S. B., and Davis, E. A. (1992). "Why some groups fail: A survey of students' experiences with learning groups". In Goodsell, A. S., Maher, M. R., and Tinto, V. (Eds.), *Collaborative Learning: A Sourcebook for Higher Education*. National Center on Postsecondary Teaching, Learning, & Assessment, Syracuse University.
Johnson, D. W., Johnson, R. T. (1987). *Learning Together & Alone, Cooperative, Competitive, & Individualistic Learning.* 2nd ed., Englewood Cliffs, NJ: Prentice Hall.
Johnson, D. W., Johnson, R. T., and Smith, K. A. (1998). *Active learning: Cooperation in the college classroom.* Edina, MN: Interaction Book Company.
Smith, K. A. (1996). "Cooperative Learning: Making 'Group work' Work" In Sutherland, T. E., and Bonwell, C. C. (Eds.), *Using active learning in college classes: A range of options for faculty, New Directions for Teaching and Learning* No. 67.
http://www.iml.uts.edu.au/learnteach/groupwork/unit3.html (Forming effective groups)
http://www.inov8.psu.edu/toolbox/alex/pdf/Help-FormingGroups.pdf

Related patterns (some to write)
Aspects to take into account when organizing project centered learning
Coaching / moderating (small) groups
Creating and enhancing trust between group members
Factors influencing the successfulness of a group for collaborative learning
Forming groups for on-line or distance collaborative learning

Author:
Gaby Lutgens
(Revision) Date: 19-02-04

Forming groups for collaborative knowledge building

Maturity level

Category
Pedagogical/ organizational

Abstract
This DP describes aspects to take into account when forming groups to collaboratively build knowledge. Participants can emerge from existing groups like classes or brought together in groups because a common interest exists. The process of collaborative knowledge building can be integrated within courses (and then last for limited duration) or be part of informal learning or learning on the job (and last as long as participants are willing to contribute). In this DP no attention will be paid to the organization of online facilities to support interaction for knowledge building.

Problem
What decisions should be made when forming groups for (online) collaborative knowledge building?

Analysis
As opposed to groups formed for group work or projects who are mostly product oriented, groups for collaborative knowledge building aim at sharing ideas and experiences in order to learn about topics or gain new insights. They are willing to interact because they trust this sharing to lead to more knowledge then when studying a topic individually. It is not common to divide roles and tasks (as again is quite often done in group work), although a discussion leader or presider often will help to focus the interaction. Again some decisions have to be made, but instead of a teacher being responsible for these, often the participants themselves take part in this decision-making. Aspects to decide on:

- who forms the group;
- decide on group size;
- topic(s) to build knowledge on;
- period to exist (as a group) or to spend on one topic;
- goal(s) to reach.

These aspects have effect on the amount of interaction between the participants and the creation of commitment and therefore the successfulness of the group (in building knowledge). Only the first two will be discussed in this pattern.

Known solutions
Who forms the group:
Depending on the vision on education of the institution or school, learners will be willing to interact and agree on not having chosen their ‘colleagues in learning’. For example

students at the University of Maastricht, built on the idea of problem based learning, attend all courses in tutorial groups of 10 to 16 students. These groups start to build knowledge collaboratively by discussing problems or tasks, define what they do not know already and share ideas and findings. But even in not yet existing groups learners will participate as long as they do not feel restricted in doing this and even see the profit of the interaction and trust equal contribution to the learning process. Bringing learners together not knowing each other as friends, from different perspectives and probably sharing diversity of ideas, are supposed to learn more (Spiro, Feltovitch, Jacobson and Coulson). Conclusion: in the context of forming groups for knowledge building it seems best for the teacher or moderator to form the groups instead of allow student-selected groups.

Sort of group:
It seems logical that heterogeneous groups lead to more interaction and therefore to more profound knowledge building and better considered solutions. For more types of groups, see the DP on forming groups for group work.

Group size:
The larger the group, the more heterogeneity will be present, but also the more difficult it can be to provide time for everyone to participate. The maximum group size is thought to be twelve. More on this topic will be explored for a DP on forming learning communities or communities of practice (often consisting of participants not personally knowing each other).

A rationale to limit the number of groups (affecting the group size) can be the number of tutors or coaches to monitor and coach the group (or time the tutor can spend coaching each group).

Procedure to form the group:
A way to form groups is related to (differing) topics or themes (e.g. courses) each group is supposed to learn about. Depending on the organization of the course the group is formed by registration (up till a maximum numbers).

Research questions
Information is still needed on how to form groups if the future members do not know each other, are not yet organized within a given context (like a course) and/or if not sure is how long the group has to function.
Also attention a DP could be added on what tools can support and enhance this knowledge building.

Context
The solution described in this pattern seems best applicable to an educational context in which students know each other and meet on a regular basis.

Conditions
Critical success factors:

◊ Authenticity of the topic
◊ Multiple solutions or perspectives to enhance critical reflection and problem solving
◊ Coach to monitor the process of working and learning together (tutor or teacher)

Discussion / consequences

References

Law, N. & Wong, E. (2003). Developmental trajectory in knowledge building: an investigation. In B. Wasson, S. Ludvigsen & U. Hoppe (Eds.), *Designing for change*, 1-6. Kluwer Academic Publishers.

Spiro, R.J., Feltovich, P.J., Jacobson, M.J., & Coulson, R.L. (1992). Cognitive flexibility, constructivism and hypertext: Random access instruction for advanced knowledge acquisition in ill-structured domains. In T. Duffy & D. Jonassen (Eds.), *Constructivism and the Technology of Instruction*. Hillsdale, NJ: Erlbaum

http://www.wcer.wisc.edu/nise/CL1/CL/moreinfo/MI3H.htm (Groups for collaborative learning)

Related patterns

Coaching / moderating small groups
Creating and enhancing trust between group members (under construction)
Factors influencing the successfulness of a group for collaborative learning
Forming groups for group work

Author:
Gaby Lutgens

Date: 19-04-03

Making a 3D virtual world effective for learning

Maturity level

Category: pedagogical - organizational

Abstract:
An online 3D world is a good platform for cooperation. How can we design cooperative activities in a 3D world, so that they may be effective from an educational point of view?
Although a 3D virtual world is not good place for study of detailed content, this activity can be performed individually offline, while the 3D technology is exploited to arise the learners' interest, allow them to discuss with remote peers and experts (with great possibilities for cross-cultural exchange), and to actively deal with cultural themes in a cooperative and most engaging way (e.g.: games).
The example reported is SEE, an educational experience about the Dead Sea Scrolls set in a cooperative 3D world.

Problem:
An online 3D world is a good platform for cooperation. People located in different geographical areas are represented by avatars (i.e. graphical 3D representations of users), which can move and interact in the 3D shared space. Thus users have the perception of sharing the same physical space: they can not only communicate in real time, but also perform actions together, and see what everyone else is doing.
Cooperation may be directed to learning. How can we design cooperative activities in a 3D world, so that they may be effective from an educational point of view?

Analysis:
A 3D shared virtual world is a good place for cooperative activities, but not for individual study of extensive, detailed content. Students may interact with other participants, perform activities together, but the delivery of extensive amounts of cultural content cannot be effectively achieved through the 3D technology. The medium offers very interesting possibilities in terms of cross-cultural exchange among students of different cultures, and in terms of engagement. How can we add the delivery of content, thus making the 3D experience effective for learning?

Known solutions:
The educational goals that can be achieved through an experience in a 3D environment are:

- to arise the interest of the students, presenting an educationally relevant theme in a novel, exciting, engaging and game-like manner;
- to allow students to discuss the theme with peers located in geographically distant areas, possibly of different culture (thus promoting intercultural exchange)

- to allow students to discuss and interact with an expert, that may be not necessarily located near the school
- to allow students to perform engaging cooperative activities (even games) aimed at favouring an active, direct approach to the theme of interest.

The study of detailed educational content cannot be performed effectively in a 3D environment. It should remain an offline activity that students perform individually on their own and/or in class with the teacher.

This is precisely what happens in SEE – Shrine Educational Experience. Students of 4 different schools (placed in different geographical areas) meet online in a 3D space, together with a guide. The aim is to learn about the Dead Sea Scrolls and discuss about culture in a broader sense, through contributions and active participation in an engaging experience.

The experience has been structured in 4 cooperative online meetings, lasting about 1 hour each. During the first one, students are introduced to the cultural theme and to each other; the first impact with the 3D world and the other students is meant especially to arise their interest.

Then, students are requested to download from SEE website some detailed content, and study it before the next cooperative session (about 1 week later). Then, they will be prepared to take part in a discussion (via chat) with the guide and with peers about the most interesting issues they have read. The discussion is stimulated and moderated by the guide (students would hardly discuss about cultural matters if left to themselves). Boards in the 3D environment activate browser windows showing pictures and few key-concepts to support the discussion (Fig. 1).

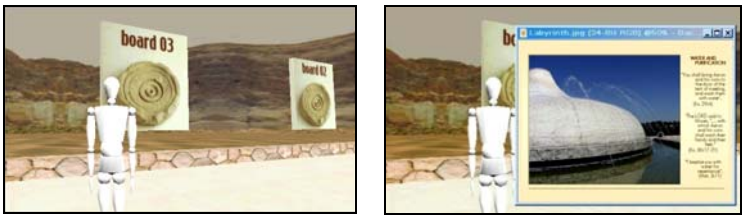


Figure 1: An avatar activates a board

Study is also needed for the games: each cooperative session includes 2 cooperative games (such as Treasure Hunts or Quizzes) with questions and puzzles about the cultural content: while very engaging because of competition and interaction elements, games become a powerful motivating factors for studying the educational material and having better chances to win. During SEE experimental phase, we saw that students came to the sessions very well prepared about the content, because they wanted to win the games.

Finally, cross-cultural exchange is particularly encouraged through the "homework": before the last cooperative session, students are asked to prepare a sort of research project, comparing aspects of the Dead Sea Scrolls culture with similar phenomena in their own local culture. Session 4 is completely dedicated to the presentation of the 4 projects made in turn by students of each class. We have seen during the experimental phase that this is definitely the most culturally engaging moment of the experience, where students get totally involved in explaining their discoveries and discussing the others' works, thus learning a lot about each other's culture.

For more details, please see the papers indicated in the references.

Research questions:
Before designing *educationally* effective cooperative activities in a 3D virtual environment, we should learn how to design *cooperative* activities effectively. Users in a 3D world do not cooperate spontaneously with each other. They need to be given an explicit common goal and clear instructions about how to achieve it. This could be the subject of another design pattern.

Context:
We have tested the SEE 3D educational experience in several schools in Italy and Israel, and the results were very rewarding. The overall organization works, students are eager to participate and teachers are satisfied with the learning objectives achieved.
With the due changes, we believe that the same learning frame may be successfully applied to the field of formation and training in companies and institutions.

Conditions:
For an educational experience in a 3D world to have success, there are some conditions that should be satisfied.
The most crucial one is that participants be intentioned to learn, i.e. they are willing to follow the directions of their supervisors and do their part as regards organizational aspects: planning a cooperative experience with more than 100 participants located in different geographical areas is a highly complex matter, which requires the collaboration of all.
(*aut disce aut discede*)
Another essential element is that educational contents should be suitable to the level of learners. They should be difficult enough to effectively challenge the preparation of students, though not so complicated to seem unsolvable; on the other hand, too simple, trivial educational material would cause students to quickly loose interest.
Obviously, the coordinator of the educational 3D experience and the supervisors of the students' groups must be fully aware and in control of the situation.

References:
www.seequmran.it
Published papers about SEE can be found in the section SEE/Facts/Papers and Presentations

Author: Caterina Poggi, Vito Perrone

Date: July 4th, 2003

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We wish to thank Nicoletta Di Blas, Paolo Paolini, Ignazio Cantoni and all the people who passionately contribute to make the Shrine project a successful experience: the editorial staff and the development team of SEE, including the invaluable contribution of Sophie s.r.l, the scientific committee, and the curatorial staff of the Israel Museum.

Private and Public spaces

Maturity level

Category:
CSCL, LMS

Abstract:
When building collaborative learning systems (and designing for collaborative learning in general) there is always a decision to make between how interweaved the collaboration should be in the system design.
Facilitating both individual and collective work in the design is regarded as important in order to make room for individual contribution and agency as well as collective interaction and problem solving.

Problem:
Co-learners need facilities for collaboration either in the design of the instruction, in the system, or both. This design should take into account the individual in the group as well as the collective. Designing only for the collective can suppress the need individuals have for supporting artefacts in order to contribute and function better in a group.

Analysis:
Designing for collaborative learning can be a difficult tasks with large set of complicated factors to consider such as task design, group size, monitoring and assessment. Research on distance education has shown that students need tools and artefacts to coordinate their own learning and effort towards a collective (Fjuk, 1998) as well as the shared tools (e.g typical group tools found in groupware such as shared calendars, whiteboards, file repositories etc.). These tools should e.g. support individuals in scheduling their activities, in order to schedule their timetables at school as well as their out off school activities (mingling).
In synchronous systems collaborate peers also need time to think for themselves, testing and organising ideas on their own before they choose to/or as they contribute to a group. One theory that takes this into account is the Mind Map theory of Tony Buzan (Buzan, 1993). In his theory he explicit make room for individual phases (in individual spaces) in collaborative processes and see them as necessary for successful collaborative efforts. Several other studies shows that individual work play a great role collaborative settings (e.g Rummel et al., 2002) and that this is something we need to facilitate for.
We need to both support the individual researching on her own in her own space with her own tools ('the quit monastery') and the collective collaborating on shared tasks ('the public bazaar').

Known solutions:

Most LMS systems provide private and public spaces with private and shared tools (some provide associated scripts and tools to structure individual effort). Steinar Dragsnes' Mind map tool (Dragsnes, 2003) provide individual spaces to facilitate individuals in making shared collaborative mind maps.

Research questions:
How to furniture the private and the public space?
Which task to facilitate in the two spaces?

Context/Conditions:
This pattern is suitable for collaborative interactions beyond mere brainstorming sessions.

Discussion/consequences :
Se research questions.

References
Buzan, T. (1993). The Mind Map Book, ISBN: 0563863738, Penguin Books, NY, USA.
Dragsnes, S. (2003). Development of a Sychronous Distributed and Agent-Supported framework: Exemplified by a Mind
map application. Cand. Polit thesis. University of Bergen, Department of Information Science.
Fjuk, A. (1998). Computer Support for Distributed Collaborative Learning. Exploring a Complex Problem Area. Dr. Scient.
Thesis. University of Oslo, Department of Informatics.
Rummel, N., Spada, H., Caspar, F., Ophoff, J.G., & Schornstein, K. (2003). Instructional Support for Computer-Mediated
Collaboration. Results from Process Analysis. InProceedings of CSCL2003. Designing for Change in Networked
Environments. B. Wasson, S. Ludvigsen, & U. Hoppe. Kluwer Academic Publishers: Printed in the Netherlands

Related patterns:
Personalisation

Author (s):
Rune Baggetun

Date:
13.01.2004
Acknowledgements:
InterMedia

Virtual Assistant

Maturity level

Category:
CSCL

Abstract:
Collaborative telelearning emphasizes the collaborative interaction in online learning communities in-between students and facilitators. The nature of the distribution puts an heavy load on coordinating the interaction between learners (e.g working in teams), and between learners and facilitators (teachers etc). Mechanisms to support the coordination work on behalf on the students and mediate the interaction are needed to lessen this load. This can be done by designing personal assistants that keep an overview of what happens and report (and support) back to the students. Incorporated into the agent/assistant there should be guidelines about how knowledge building communities best flourish scaffolding interaction, creating and encouraging for richer interactions and opportunities for learning.

Problem:
Students have difficulties in following and structuring an cohesive joint effort/interaction on learning tasks when working collaboratively in distributed teams. This often lead to little activity, scattered contributions, alienation, and students feeling they are wasting their online time.

Analysis:
Collaborative telelearning emphasizes the collaborative interaction in online learning communities in and between students and facilitators. By following Salomon's (1992) recommendations, collaborative learning environments should be designed to encourage mindful engagement (voluntary expenditure of task related mental effort) among the participants through genuine interdependence. Genuine interdependence is characterized by Salomon as the necessity to share information, a division of labor and the need for joint thinking. In such settings there is a need for monitoring and facilitating this kind of pedagogy (Wasson, 1998, p.280).
These guidelines are great but we often see that students have difficulties in following and structuring joint cohesive interaction on learning tasks when working collaboratively in distributed teams. This often leads to alienation and high drop-outs rates in e-learning programs. Another major problem is scattered efforts and little persistent cohesive activity along with unwanted group effects like 'ganging upon the task' and the 'sucker effect' (Salomon Globerson, 1989).
The complexity in collaborative telelearning scenarios can roughly be seen from two different points of view.

From the instructor's view, collaborative telelearning is hard to monitor and facilitate. It is difficult to notice when a point of genuine activity occurs (e.g. when the students are online working or not) and progression is often not streamlined due to different timetables, local culture, and the individual student's personal preferences.
From a student's perspective, it is also difficult to coordinate and align joint collaborate activities due to much of the similar problems. The problems of coordinating the distributed learning activities often require a "tremendous" effort on the students and the facilitators. The challenge is to move some of this "burden" from humans to ICT based artifacts.

Known solutions:
Make an assistant (or virtual friend) for each student or for each team of students that monitors what goes on and gives sound advices for how to collaborate in e-learning. The assistant should keep track of what is going on in the student's virtual environment (assignments, news, messages, collaborative task progress etc.), and in this way support and strengthen the necessary interdependencies between actors in telelearning environments.
This is a design pattern grown out of InterMedia experiences with how collaborative learning should be supported in distributed settings. In this work we have been using FLE3 (see http://fle3.uiah.fi) and developed our own extensions (various assistants and agents) to support both teachers and students.

Research questions:
How should sound advices and wisdom about collaboration be incorporated in the assistant?
How should the assistant be presented to the student ?
Who should own the assistant?

Context/Conditions:
This pattern is particular pertinent to situations where there are non or few face-to-face meetings, or in situations where there are loose relationships between the learners, and also applicable in settings where the learners are considered novices in e-learning.

Discussion/consequences :
To be discovered.

References
Salomon, G. & Globerson, T. (1989) When teams do not function the way they ought to. International journal of Educational
research., 13 (1), 89-100.
Salomon, G (1992). What does the design of effective CSCL require and how do we study its effects? SIGCUE Outlook,
Special Issue on CSCL, 21(3), 62-68.
Wasson, B. (1998). Identifying Coordination Agents for Collaborative Telelearning. In International Journal of Artificial
Intelligence in Education, 9, pp. 275-299.

Related patterns:
Personalisation

Author (s):
Rune Baggetun
Date:
30.10.2003

Student, know your past

Maturity level

Category:
Learning patterns

Problem:
How can students be informed on their past activities in a course?

Analysis:
Students typically attend a number of courses at t e same time, and the effort to keep up to date can be cumbersome.

Solution:
To aid student awareness on completed and remaining lessons and tasks, different types of information can be displayed. By continuous logging of student interaction, the system can offer t e student a history of visited pages, chats, tasks and more.

Known uses:
Solutions are found in: WebCT....., IT's Learning.

Context:
This pattern is applicable to LMS designers, and it's target users are students.

References:
Koichi Hayashi, Tan Hazama, Takahiko Nomura, Toshifumi Yamada, Stephan Gudmundson: Activity Awareness: Framework for sharing knowledge of people, projects, and places. ECSCW 1999
Wexelblat, A. and Maes, P. (1999). Footprints: History-Rich Tools for Information Foraging. In Proceedings of Conference on Human Factors in Computing Systems (CHI'99), pp. 270-277.
http://citeseer.ist.psu.edu/wexelblat99footprints.html

Related patterns:
Student tracking (original pattern)
Support choices by providing feedback on collaborative behavior (Social Navigation)

Shape electronic environment for interactive activity

Maturity level

Category:
Technical/ pedagogical

Problem:
How is interactive activity between learners in an electronic environment promoted?

Analysis:
- Activity of learners is important to acquire specific learning objects
- Learners are busy with many competing (real-life) activities next to the electronic course they are taking
- Different learners within a group have different aims and reasons to participate in an electronic course
- In practice it can be very hard to find a moment to 'meet' people electronically due to the different lives and schedules people have
- Personal characteristics of learners may motivate or depress interaction within a group

Known solutions:
Take the following factors into account while designing an electronic environment:
- make it *easy accessible*[10]
- *alert* users *when there's action/activity* in the environment: this can be any activity like looking at text, writing etc.
- give users the possibility to adapt (add, delete, change) the environment to their needs, in a functional (add/change instruments, structures) as well as a conceptual sense (lay relations between subject-related input of people), *locus of control on users*
- make *effects of actions directly visible* for users, on a personal and a group level
- fit information and possible actions to needs of a learner, so a learner can see direct value of participating, *personalised view and environment for learners*
- *make meta-information available* for users

Context:
You are designing and creating a learning environment in which active input, interaction and participation of the learners is important for the acquirement of (learning) objects

Conditions:
To be able to design and create an interactive environment you need the following:

[10] All italic words are all new patterns, which have to be constructed (see related patterns)

- a flexible instrument which is able to meet above-mentioned functionality

Author (s):
Ellen Rusman

Date:
18 september 2003