Encouraging collaboration within learning design-based open source e-learning systems

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Abstract: This paper outlines some innovative solutions to the design of 'collaborative learning patterns' within the context of open source 'learning design' based e-learning systems. The proposed solutions emphasize the design and development of a set of computer-based collaborative patterns reflecting diverse collaboration methods, namely: Team Expectations, Uncommon Commonalities, Roundtable, Numbered Heads Together, Focused Listing, Think-Pair and Share, One minute papers, Jigsaw II and Co-op Co-op. These patterns are content free and could be used as scaffolding elements for the design of collaborative learning activities for online and blended courses. Specific examples of the implementation of these patterns within well-known web-based open source environments that support learning design such as LAMS are also presented.

Introduction

The idea that collaboration is a basic form of human activity, essential for cultural development, is intensively stressed by many researchers throughout the history of psychology (Vygotsky, 1962; Bruner, 1996; Engestrom, 1987; Tomasello, 1999; Lipponen, 2002). Nowadays, in a rapidly changing society, to prepare learners for participation in socially organized activities is also one of the essential requirements (Hakkinen, and Jarvela, 2006). However, in collaborative situations, the participants are mutually involved in shared activities; they must coordinate their efforts if they are to solve problems together. Contrariwise, in cooperative settings the task is split into subtasks and each participant is responsible for solving a portion of the problem at hand (Dillenbourg, 1999).

E-learning has provided education with many benefits in terms of flexible opportunities to learn anytime and anywhere as well as to communicate and collaborate virtually throughout the world (Harasim, Hiltz, Teles & Turoff, 1995). Recent studies of e-learning have pointed out that involving learners in collaborative learning activities could positively contribute to extending and deepening their learning experiences, test out new ideas, improve learning outcomes and increase learner satisfaction, at the same time decreasing the isolation that can occur in an e-learning setting (Palloff and Pratt, 2004). Furthermore, collaborative learning situations can provide a natural setting for demanding cognitive activities such as explanation, argumentation, inquiry, mutual regulation etc., which can also trigger collaborative learning mechanisms such as knowledge articulation as well as sharing and distributing the cognitive load (Dillenbourg, 1999). Within the context of online collaborative learning, students could also be provided with opportunities to be motivated to actively construct their knowledge and to enhance their diversity and their understanding of the learning concepts in question as well as to acquire a sense of belonging online (Scardamalia, and Bereiter, 1996; Haythornthwaite, Kazmer, Robins, and Shoemaker, 2000). On the whole, computer-supported collaborative learning has been recognized as an emerging paradigm of educational technology (Koschmann, 1996).

However, many teachers remain unsure of why, when, and how to integrate collaboration into their teaching practices in general as well as into their online classes (Panitz, 1997; Brufee, 1999). It is also worth mentioning that the abundance of theoretical considerations and models that provide teachers with resources for 'learning design' remains largely unused in their real teaching practices (Brufee, 1999). At this point, we shall use the term 'learning design' to indicate all the elements of learning activity design, e.g. a learning task to be posed to the students, a set of questions, the group formation, the learning materials to be used by the students, learning assessment, etc. (Koper and Tattersall, 2005).

Recent studies have indicated that some amount of structuring may help teams achieve effective collaboration (Lehtinen, 2003). One way to structure collaborative processes employs so-called collaboration scripts (Dillenbourg, 2002). A Computer Supported Collaborative Learning script (or scenario) structures the collaborative process in order to promote specific types of interactions (Dillenbourg, 2002). Such scripts are intended to facilitate collaborative learning processes and guide learners' activities. A script segments the task into phases, defines roles and places various constraints on the interactions. In scripted collaboration, the participants are supposed to follow directions and undertake shared learning tasks. Another way of structuring collaboration is through the use of collaborative patterns which could be well-integrated within 'learning design' based e-learning environments. These environments seem promising and revolutionary contexts for the design of pedagogically sound e-learning events. In fact, a 'learning design' is defined as the description of the teaching-learning process that takes place in a unit of learning (eg, a course, a lesson or any other designed learning event such as a specific collaboration structure) (Koper and Tattersall, 2005). An important part of this definition is that pedagogy is conceptually abstracted from context and content, so that excellent pedagogical models can be shared and reused across instructional contexts and subject domains. Specifically, best pedagogical practices can be reflected in the formation of 'design patterns' which could be shared and reused across instructional contexts and essentially assist online learning. A pattern is seen as something that will not be reused directly but can assist the informed teacher to build up their own range of tasks, tools or materials that can draw on a collected body of experience (McAndrew, Goodyear, Dalziel, 2006). In the context of "learning design', the role of collaborative design patterns is to indicate clearly the flow of collaboration activities using specific collaboration methods.

The IMS Learning Design (LD) specification aims to represent the design of units of learning in a semantic, formal and machine-interpretable way (LD, 2003). Various examples of e-learning environments close to the LD specification are mentioned in the literature. COLLAGE is also a system close to IMS-LD specification that is friendly for teachers to use and which supports collaboration using design patterns (Hernández-Leo, Villasclaras-Fernández, Asensio-Pérez, Dimitriadis, Jorrín-Abellán, Ruiz-Requies and Rubia-Avi, 2006). However, despite the fact that the IMS-LD specification offers many pedagogical benefits when compared with earlier open specifications for eLearning, it is not easy for teachers to understand and work with it (Griffiths, & Blat, 2005). To this end, it seems clear that teachers need high level tools to understand learning design and it is likely that tools specialized for a particular pedagogic context will be easier to use (Griffiths, & Blat, 2005). Such tools are essential in all types of education including web-based and blended education settings (Koper and Tattersall, 2005).

The essential role of suitably-designed tools to support teachers in their mindful and appropriate 'learning design' has been acknowledged by many researchers (Lloyd & Wilson, 2001; Babiuk, 2005; Kordaki, Papadakis, & Hadzilakos, 2007; Kordaki & Daradoumis, 2009). In fact, teachers require more specific support in their learning design practices, such as specific tools and good examples of lesson plans. Thus, teacher encouragement and support for learning design is clearly needed. To this end, the role of learning design patterns has been acknowledged as essential (McAndrew, Goodyear, Dalziel, 2006). Learning patterns looks to work on Architectural Patterns (Alexander, 1979) as a way to capture knowledge from designers and share them with practitioners. Furthermore, it is worth noting that the type of editor that classroom teachers usually need should be similar to the authoring environment provided by LAMS (Learning Activity Management System; http://www.lamsfoundation.org/). Specifically, LAMS (Dalziel, 2003) is a well known integrated e-learning system that supports the idea of 'learning design'.

Nevertheless, Dalziel (2003) has commented on the absence of tools supporting broader ranges of collaborative tasks and also on missing support for the concepts of group creation and monitoring. In fact, despite the variety of tools provided by LAMS, collaborative activity sequences for the performance of specific collaboration methods within LAMS have not yet reported. However, the tools provided by LAMS can be combined to support the implementation of diverse collaboration design patterns reflecting different collaboration methods. One of the contributions of this paper is to propose specific implementations of a number of essential collaboration methods using the previously mentioned tools of LAMS. We advocate the use of patterns (Alexander, 1979) that reflect best practices in collaborative learning structuring as LAMS templates that can be applied to many collaborative learning situations.

This paper is organized as follows: In the next section, the context of LAMS is further discussed with an emphasis on its specific features used for the design and implementation of the proposed collaboration design patterns. Such design has not yet been reported. Next, the implementation of these design patterns within LAMS is

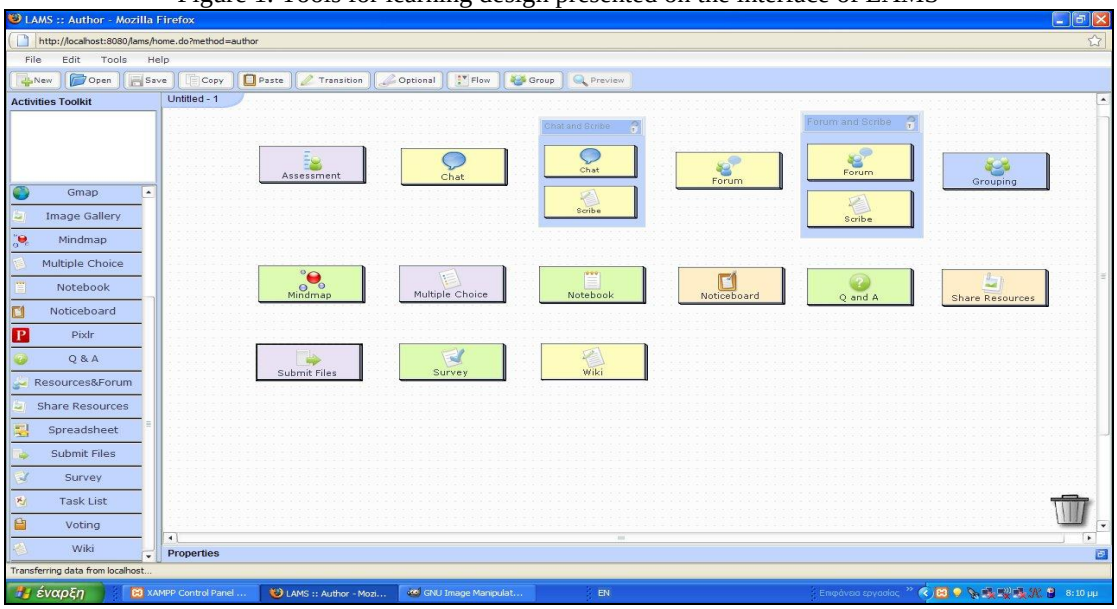
demonstrated. Finally, the proposed collaborative design patterns are discussed while conclusions and future research plans are also drawn.

Features of LAMS used for the implementation of content-free collaboration patterns

LAMS is an open source tool for designing, managing and delivering online collaborative learning activities. In fact, LAMS offers a set of predefined learning activities, shown in a comprehensible way for teachers, which can be graphically dragged and dropped in order to establish a flow chart of sequence of activities. When using LAMS, teachers gain access to a highly intuitive visual authoring environment for the creation of sequential learning activities. These activities may be individual tasks, small group work or whole class activities. LAMS is based on the belief that learning does not arise simply from interacting with content but from interacting with teachers and peers. The creation of content-based, self–paced learning objectives for single learners is now well understood in the field of e-learning. However, the creation of sequential learning activities which involve groups of learners interacting within a structured set of collaborative environments - referred to as 'learning design' - is less common; LAMS allows teachers to both create and deliver such sequences. In essence, LAMS provides a practical way to describe multi-learner activity sequences and the tools required to support these. Furthermore, LAMS provides tools that support various activities such as communication, presentation of information, writing and sharing resources as well as posing and answering questions.

A number of content-free collaboration methods were implemented using some essential tools provided by LAMS (http://wiki.lamsfoundation.org/display/lamsdocs/Home). These tools are demonstrated in the interface of LAMS (Figure, 1) and are briefly presented below:

Figure 1. Tools for learning design presented on the interface of LAMS



- The *Assessment* tool that allows sequence authors to create a series of questions with a high degree of flexibility in total weighting
- The *Chat* Activity runs a live (synchronous) discussion for learners
- The *Chat and Scribe* Activity combines a *Chat* Activity with a *Scribe Activity* for collating the chat group's views on questions posed by the teacher
- The *Forum* Activity provides an asynchronous discussion environment for learners, with discussion threads initially created by the teacher
- The *Forum and Scribe Activity* combines a *Forum* Activity with a *Scribe Activity* for collating Forum Postings into a written report

- The *Mindmap* activity allows teachers and learners to create, edit and view mindmaps in the LAMS environment. Mindmaps allow for the organising of concepts and ideas, and exploring how these interact
- The *Multiple Choice* activity allows teachers to create simple automated assessment questions, including multiple choice and true/false questions
- The *Notebook* Activity is a tool for learners to record their thoughts during a sequence of activities
- The *Noticeboard* Activity provides a simple way of providing learners with information and content. The activity can display text, images, links and other HTML content.
- The *Question and Answer* Activity allows teachers to pose a question or questions to learners individually, and after they have entered their response, to see the responses of all their peers presented on a single screen
- The *Share Resources* tool allows teachers to add content into a sequence, such as URL hyperlinks, zipped websites, individual files and even complete learning objects
- The *Submit Files* Activity allows learners to submit one or more files to the LAMS server for review by a teacher
- The *Survey* Tool presents learners with a number of questions and collects their responses. However, unlike Multiple Choice, there are no right or wrong answers
- The *Wiki* Tool allows authors to create content pages that can link to each other and, optionally, allow learners to make collaborative edits to the content provided.

A number of essential content-free collaborative methods were selected –to be implemented as design patterns within LAMS- as being representative of the achievement of diverse learning objectives such as: enhancing team building and engagement of students in conversation (*Team Expectations;* Felder & Brent, 2000), finding similarities and differences among the participants in a group (*Uncommon Commonalities;* Kagan, 1994), the generation of a large number of ideas for the solution of a problem (*Roundtable;* Kagan, 1994), involving the whole class in the consideration of a question or problem, while at the same time increasing individual accountability (*Numbered Heads Together;* Kagan, 1992;1994), developing the ability to concentrate on important terms (*Focused Listing;* Angelo and Cross, 1993; Johnson, and Johnson, 1999), encourage critical thinking (*Think-Pair-Share;* Lyman, 1981), developing student metacognitive skills as well as quick and easy assessment of the knowledge constructed during a lesson (*One minute papers;* Angelo and Cross, 1993), promoting cooperative learning through accountability and positive interdependence (*JigsawII;* Slavin, 1990) as well as cultivating student ability to approach problems with different structures (*Co-op Co-op;* Kagan, 1985). To avoid repetitions, in the next section of this paper, we analytically present the previously mentioned set of collaborative methods, in combination with their implementation as collaborative design patterns using the previously mentioned tools of LAMS. The presentation of these patterns is to help synchronous collaboration but these patterns could be also used for asynchronous collaboration by substituting the function of "Chat and Scribe" by the "Forum and Scribe" function.

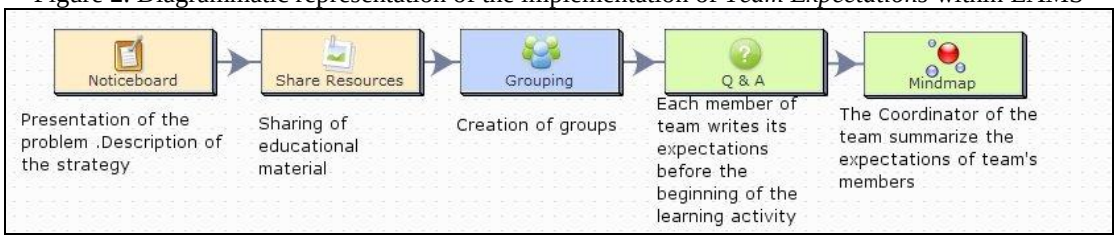
Implementation of essential content-free collaboration methods as design patterns within LAMS

1. Team Expectations

This method (Felder & Brent 2000) was designed to soften students' fears of for possible reduced grades. All the team members have to commit and respect an agreement based on their mutual expectations.

Goals: 1) for students to commit to better behaviour and control of possible disputes, 2) for students to accept responsibility for collaborative learning, 3) to encourage team building consciousness.

Figure 2. Diagrammatic representation of the implementation of *Team Expectations* within LAMS



Process: 1) Sharing of educational material, 2) Questions about the team expectations of each student, 3) Grouping in teams, 4) The members of teams write down their expectations about the forthcoming learning activity, 5) The

coordinator of the team summarizes the members' expectations and takes care to see they are fulfilled. A diagrammatic representation of this method within LAMS is presented in Figure 2.

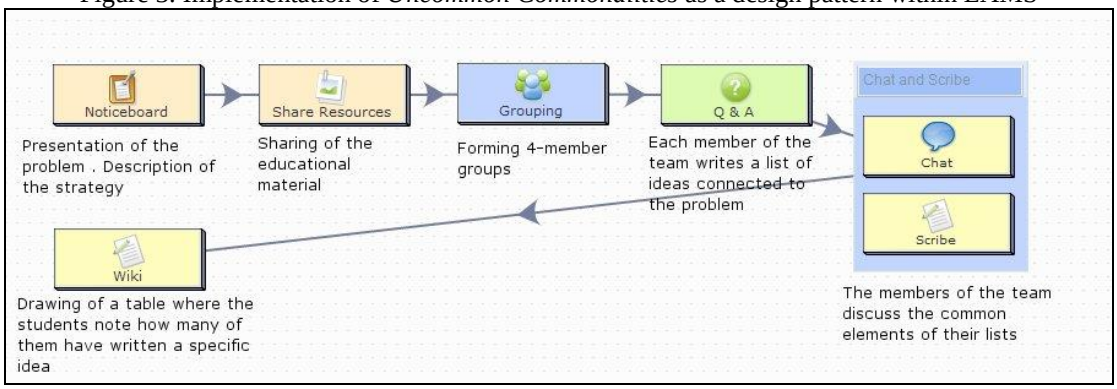
2. Uncommon Commonalities

This method (Kagan, 1994), explores the similarities and the differences existing among the learners.

Goals: 1) to establish areas of common interest, 2) to establish reasons to work together, 3) to enhance the teambuilding process.

Process: 1) Sharing of the educational material, 2) Grouping in teams of 4 members, 3) Each member of the team writes down a list of key points, 4) The members of each team discuss and mention common key points. A diagrammatic representation of this method –as a design pattern within LAMS- is presented in Figure 3.

Figure 3. Implementation of *Uncommon Commonalities* as a design pattern within LAMS



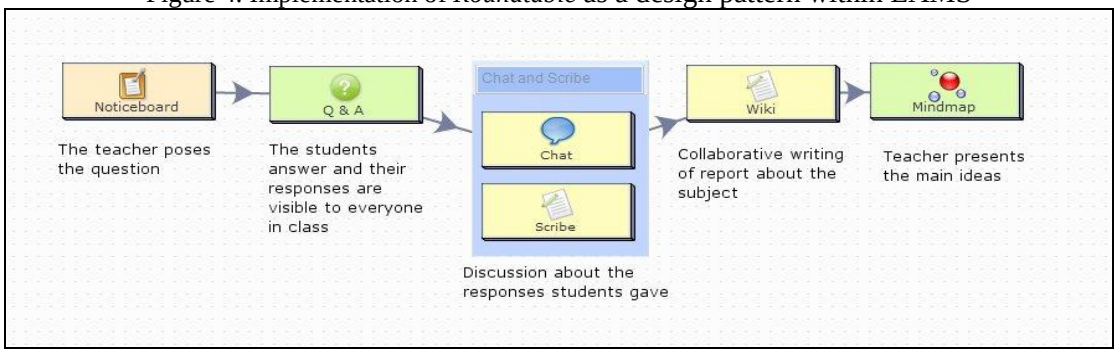
3. Roundtable

Roundtable (Kagan, 1992) is one of the classical brainstorming techniques. Due its structure it is obligatory for learners to participate and contribute in discussions.

Goals: 1) to express students' ideas, 2) to produce multiple solutions to a problem, 3) to set the stage for upcoming discussions, 4) to reinforce the power of teamwork.

Process: 1) The teacher poses a question, 2) One-by-one, all students answer the question within a given time, 3) The students discuss the possible answers, 4) The students collaborate on the writing of a final report 5) Teacher presents the main ideas of the lesson. A diagrammatic representation of this method –as a design pattern within LAMS- is presented in Figure 4.

Figure 4. Implementation of *Roundtable* as a design pattern within LAMS



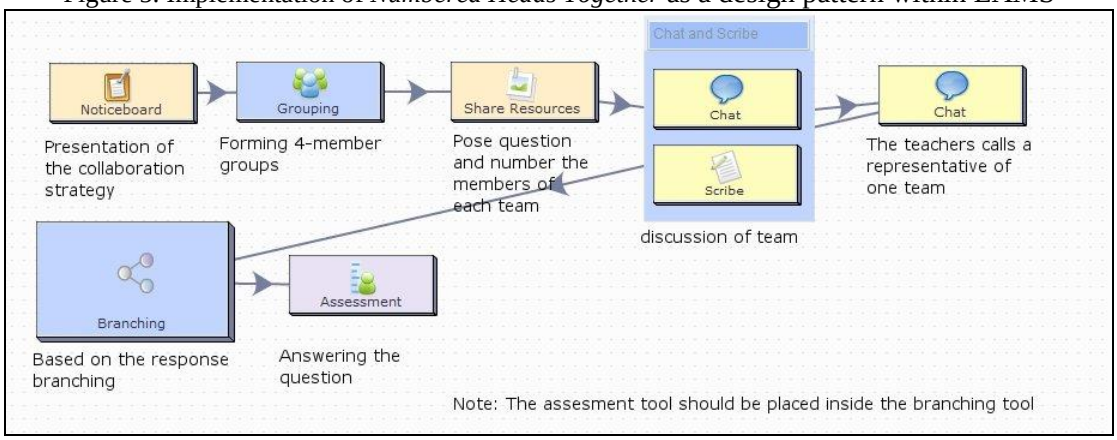
4. Numbered Heads Together

The method of *Numbered Heads Together* is derived from the work of Spencer Kagan (Kagan, 1994). There are a number of variations on the method, some very simple and others with a greater degree of complexity. This method can be used in conjunction with 'Think-Pair-Share' early in the development of the Co-operative Classroom.

Goals: 1) To involve the whole class in the consideration of a question or problem, 2) To increase individual accountability, 3) To increase group teaching so that all members of the group receive coaching, 4) To increase team spirit and satisfaction, 5) To give support to all students in consideration of challenging questions or problems.

Process: 1) Formation of 4-member groups, 2) Posing of a clear question and numbering of the members of each group, 3) Discussion and attempt to provide mutual and comprehensive answer, 4) The teacher calls a number and the corresponding member must respond. A diagrammatic representation of this method –as a design pattern within LAMS- is presented in Figure 5.

Figure 5. Implementation of *Numbered Heads Together* as a design pattern within LAMS



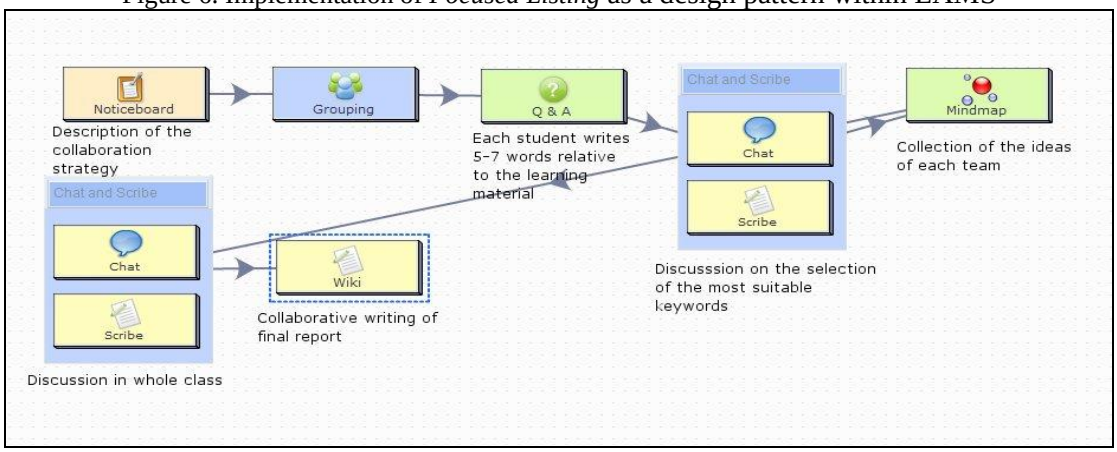
5. Focused Listing

This method (Angelo & Cross 1993), is a representative of class assessment techniques (known as CAT). The main focus of the teacher is to compare his initial lists with learners' lists. This way he can modify his lesson plan emphasizing specific ideas.

Goals: 1) to improve memory skills, 2) to learn terms and facts about a subject, 3) to develop appropriate study skills, 4) to develop ability to concentrate on important terms.

Process: 1) Grouping, 2) Each student writes 5-7 keywords describing the main ideas of the subject being taught, 3) The members of each team decide which are the important points, 4) Team presents the main ideas, 5) Further whole class discussion, 6) Collaborative writing of a final report. A diagrammatic representation of this method –as a design pattern within LAMS- is presented in Figure 6.

Figure 6. Implementation of *Focused Listing* as a design pattern within LAMS



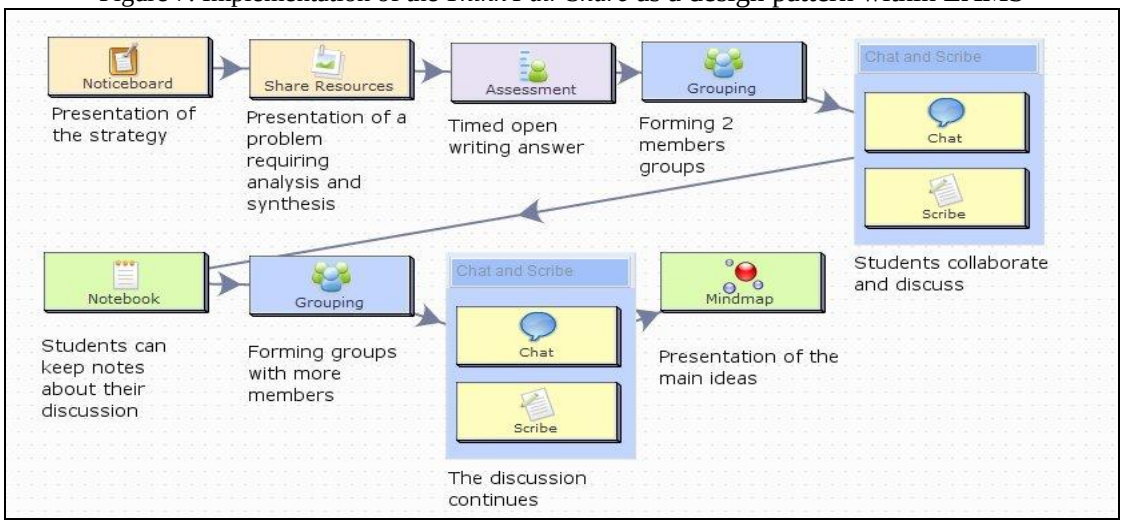
6. Think Pair Share

Think, Pair, Share is a method first designed by Professor Frank Lyman at the University of Maryland in 1981. It is a cooperative discussion method that allows students to discuss their responses with a peer before sharing with the whole class. It distinguishes from other methods by the adoption of thinking time leading to increases in responses' quality.

Goals: 1) to increases quality of student responses by providing "think time" 2) to actively involve students in thinking about the concepts presented in the lesson, 3) to encourage retention of more critical information by giving

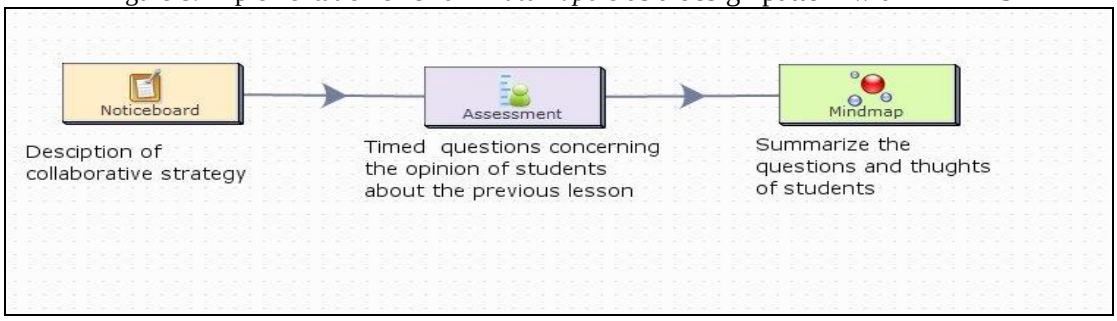
students time to "think-pair-share" throughout the lesson. When teachers present too much information all at once, much of that information is lost.. 4) to make students more willing to participate since they do not feel the peer pressure involved in responding in front of the whole class. 5) to facilitate large classes due to ease of use.
Process: 1) The teacher sets questions, 2) Students are given some time to answer, 3) Creation of groups in pairs, 4) Collaboration and discussion, 5) Creation of groups with more members, 6) Continuation of discussion, 7) Presentation of the main ideas. A diagrammatic representation of this method –as a design pattern within LAMS- is presented in Figure 7.

Figure 7. Implementation of the *Think Pair Share* as a design pattern within LAMS



7. One Minute Papers
The *One-minute papers* (Angelo & Cross 1993) is a quick and easy assessment tool that helps teachers to identify where misunderstanding occurs, while it also gives learners an opportunity to test their comprehension. It can also be used as a reflective tool encouraging learners to correlate their personal representations with the newly acquired knowledge.

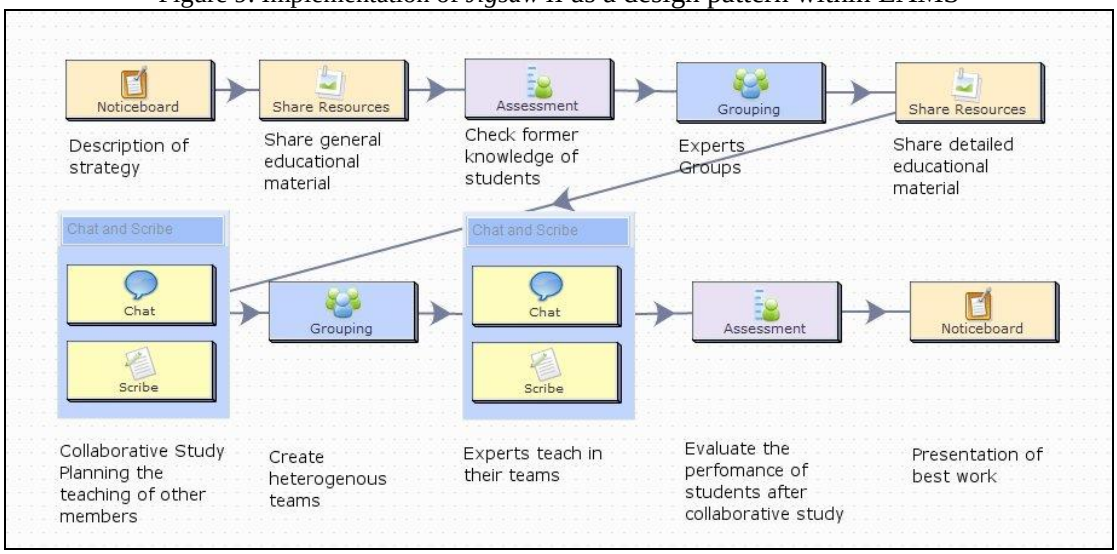
Figure 8. Implementation of *One Minute Papers* as a design pattern within LAMS



Goals: 1) to develop the meta-cognitive skills of students, 2) to facilitate discussion between members of the team, 3) to collect feedback about the comprehension of learning material.
Process: 1) The students comment on the most useful things they have learnt and what they want clarified, 2) Teacher gives students 1 minute to express themselves, 3) Teacher presents the main questions from the students. A diagrammatic representation of this method –as a design pattern within LAMS- is presented in Figure 8.

8. Jigsaw II
The *Jigsaw II* (Slavin, 1990) teaching technique combines the best virtues of traditional Jigsaw (Aronson, Blaney, Sikes, Stephan & Snapp, 1978) and STAD (Slavin, 1978). However, when using Jigsaw II, learners have to study the whole of the materials given. The evaluation of students' former knowledge and the reward of best projects are the specific parts adapted from STAD. A diagrammatic representation of this combined method –as a design pattern within LAMS- is presented in Figure 9.

Figure 9. Implementation of *Jigsaw II* as a design pattern within LAMS



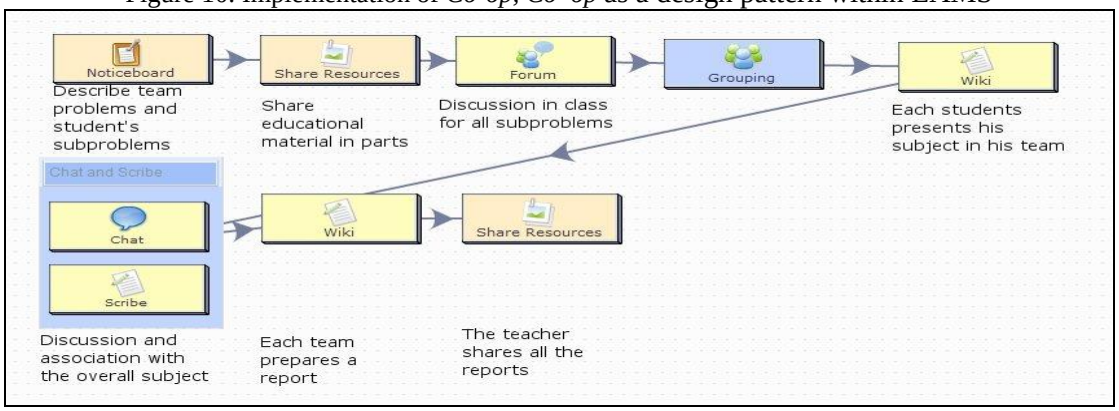
9. Co-op, Co –op Method

This method was proposed by Kagan (1985). It belongs to the category of methods focusing on the development of group consciousness inside class (class building techniques). The learner undertakes the responsibility to control what and how he learns. There is a little interaction among the teams.

Goals: Similar to the previous method. The main aim is to cultivate the ability of students to approach problems with different structures.

Process: 1) Division of the problem into team sub-problems, and later into student sub-problems, 2) Sharing of the educational material, 3) Each student prepares his subject, discussing it in class in order to collect more info, 4) Creation of groups, 5) Each student presents their report to their group, 6) Discussion of the connection of the sub-subject to the whole, 7) Preparation of the team report, 8) Presentation in class of group reports. A diagrammatic representation of this method –as a design pattern within LAMS- is presented in Figure 10.

Figure 10. Implementation of *Co-op, Co–op* as a design pattern within LAMS



Summary and Future Plans

In our attempt to help novices and teachers in their approaches towards successful collaborative learning design, we designed and implemented a number of collaborative design patterns within LAMS, reflecting essential collaboration methods, namely: Team Expectations, Uncommon Commonalities, Roundtable, Numbered Heads

Together, Focused Listing, Think Pair and Share, One minute papers, Jigsaw II and Co-op Co-op. We also plan to provide novices and teachers with extra support in their attempts to design collaborative online courses, in terms of good examples of online courses incorporating the previously mentioned collaborative methods. The use with real teachers of the previously mentioned collaboration methods - as collaborative design patterns implemented within LAMS - is also in our future plans. In this way, the effectiveness of these patterns in the form of this specific implementation could be explored.

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