E-Cooperation Patterns in Software Development Virtual Meetings

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Summary
Developing and implementing software project is considered a teamwork effort that requires good collaboration and communication. Face-to-face meetings are not always feasible in some settings, such as, outsourcing, scattered stakeholders needed for requirements' negotiating, remote quality team reviewers, etc.
Designing successful virtual meeting sessions is generally a challenging task for a typical organizational management. Virtual distant, bandwidth limitation, and expensive hardware setting are some examples of such challenges facing managers when deciding to conduct their meeting in the online environments. Furthermore, assuming that by providing the most advanced communication tools it will ensure a successful virtual meeting is a mistaken belief. Providing software developers with communication tools included at the organization home page and expecting them to collaborate by using these tools might lead to many disappointments. Many organizational managers are reporting serious frustration when conducting virtual informal meetings with their employees. There are usually the risks that participants cannot start, get lost, or cannot reach the stated meeting's objectives.
There is a real need to shift our focus from tools to processes that include defined structures and formality when designing our virtual meeting. Designing a successful meeting process in the virtual environment is demanding. It is considered to be more resource intensive (facilitator's time, effective planning, appropriate technical background, etc.) than designing and planning traditional face-to-face session. We believe that defining and applying OECP (Organizational E-Cooperation Patterns) should lead to more effective participants' commitment in reaching meeting's objectives. In this paper we will introduce E-Cooperation patterns used in e-learning field as a starting point for defining a wider set of OECPs. Many E-Cooperation patterns are already been used in the traditional software management sessions, such as Round Table Discussion, Brainstorming, Group Nomination, Debate, Jigsaw, Pro/Contra, etc. Finally, we will present several CSCL (Computer Support of Collaborative Learning) systems that could be used to support these types of patterns.

Key words:
Software Development Process, CSCW, Collaboration, Patterns

1. Introduction

CSCW (Computer Support of Collaborative Work) was introduced early in 1980' to define systems that can support network working [1]. It is defined as a computer-based network system that supports group work in a common task and provides a shared interface for groups to work with [2]. The CSCW tends to focus on communication technology themselves that are used mainly in the business setting. These communication technologies were intended to assist organizations in various ways, such as:

- Reserving and retrieving knowledge management data that is embedded in the everyday work to improve the quality of the offered services and the workers satisfaction.
- Encouraging worker to communicate, co-operate, co-ordinate, solve problems, compete, and negotiate to establish human relationships in working settings.
- Supporting groups that are small project-oriented teams that have important tasks and strict deadlines.
- Supporting the processes that lead to management decisions

Various CSCW systems have been developed in the past few years. Most of these systems are based on a limited set of tools. These tools have been divided in two main categories: asynchronous tools and synchronous tools. Asynchronous tools enable cooperation at "anytime, anyplace", providing more management freedom such as email, Forum, Q/A, Wiki, Weblogs, File-sharing etc . These types of tools are appropriate for cooperation that requires more time for reflection. Synchronous tools enable "same-time, anyplace" cooperation, providing immediacy and faster response, such as Audio/Video Conferencing, Text Chatting, Application sharing, Whiteboard drawing, Polling, etc.

Nevertheless, relying exclusively on providing these general communication technologies to initiate and produce successful collaborative meetings is not sufficient. Structuring meeting sessions in a formal way is important to achieve proper outcomes. Designating session's process that includes specific cooperation techniques is essential to conduct effective knowledge construction among organization employees. Participants should understand

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clearly what they are expected to do, who will do what, and what the objectives are behind doing it.

Therefore, session designer should start by defining session's objectives and by selecting appropriate techniques not by just tool selection.

2. Cooperation Patterns

The interest in capturing and recording successful designs that can be reused by less-experienced practitioners has surged in many disciplines [3]. Christopher Alexander was a pioneer employing patterns to communicate good practices in the construction of towns and buildings, using architectural design and arrangement techniques [4]. His theory states that each design problem is the result of certain forces in a specific context and patterns should describe a way to resolve these forces. He stated that "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" [5]. A pattern seeks to organize information regarding a contextualised common problem and its broadly accepted solution couple in a specific context, and presents them in a design that can be reused by non-expert practitioners within similar settings [6]. A pattern does not provide a complete solution but rather provides enough guidance to allow users customization and intervention in each reuse [3].

. Despite the fact that the word "pattern" has been widely used in different disciplines, its use is better known in the fields of architecture and software engineering [7]. Currently, other domains (for example, E-Learning) [8] are moving toward using patterns. In this paper we investigate the potential of extending the use of Cooperation Patterns used in E-learning into the business domain. Cooperation Patterns take into accounts both material and social issues which are common in both learning and organizational environments.

A literature review on the various Collaborative Patterns (in some literature called Collaborative Techniques) that have been used in classrooms shows that there are more than 100 techniques [9-11], such as Round Table Discussion, Brainstorming, Group Nomination, Debate, Jigsaw, Pro/Contra, Think Pair Share, Pyramid, Buzz, Interview, Role Play, Case Study, Team Pair Solo, etc. All these techniques can be presented in a pattern format. The Alexander patterns [4] have this structure:

i) A picture (showing an archetypal example of the pattern)
ii) An introductory paragraph setting the **context** for the patterns.
iii) **Problem headline**, to give the essence of the problem in one or two sentences.
iv) The body of the problem (its empirical background, evidence for its validity, **examples** of different ways the pattern can be manifested).
v) The **solution**, stated as an instruction, so that you know what to do to build the pattern.
vi) A paragraph linking the pattern to the smaller patterns which are needed to complete and embellish it.

We present Goodyear's notation [12], which varies from Alexander's notation but still contains the fundamental principles, to represent Collaborative Learning Patterns (CLP). For example, the GNT pattern is presented in Table 1.

Table 1: GNT pattern

CLP	**GNT Group Nomination Technique**
Problem	How to establish and encourage group decision-making of a certain topic or problem without a specific solution whose resolution implies not only creating ideas or solutions, but also choosing the best idea.
Context	Small groups of students with different skills and backgrounds interact to create ideas and reach a resolution of a specified problem.
Session's Agenda (flow of session's step)	1. a Session facilitator specifies the proposed project objectives 2. Posting ideas, no criticism or elaboration is allowed in this step. 3. Discussing posted ideas to obtain clarification and evaluation. 4. Idea-prioritizing, each participant is asked to assign a mark for each idea. 5. Idea-reporting, reporting the highest idea

3. Organizational Cooperation Patterns

Similar to E-Learning, applying E-Cooperation patterns inside various organizational activities that involve internal negotiation and deliberate actions, such as goal setting, requirement negotiation, faults identification, etc. Looking back at the GNT pattern we can easily realize that this pattern can be reused in business organizational environment. We think that it is critically important to start studying and analyzing cooperation patterns used in adult

education and to investigate how we can customize and adopt some of these patterns to extend their usage during software development phases that require group based cooperative meetings.

As mentioned earlier, many face-to-face cooperative techniques are already familiar within software management sessions (Brainstorming requirements, interviewing end-users, Joint Application Design JAD, requirement negotiation, requirement prioritization). These techniques could be considered as an ideal start for defining a wider set of Organizational Cooperation Patterns OCP. In this paper we present an adoption of Goodyear's notation to represent these Organizational Cooperation Patterns. The following example represents the Requirement Brainstorming pattern which is included in Table 2

Table 2 Requirement Brainstorming OCP

OCP	**Requirement Brainstorming**
Problem	How to motivate a stakeholder group to generate many creative new ideas or solutions.
Context	Small group of stakeholders with different skills and backgrounds interact to create requirements by not allowing criticism or elaboration.
Session's Agenda (flow of session's step)	1- Session manager specifies the proposed project objectives. 2- Participants start posting their requirements. 3- Chairperson records these requirements on a whiteboard in front of the stakeholders to simulate new ideas generation.

4. E-Cooperation Model

E-Cooperation in the other hand is defined as "any kind of group cooperation that takes place mainly in a virtual environment" [13]. E-Cooperation is based on the promise that computer supported systems can support and facilitate group process and group dynamics in similar ways that are achievable by face-to-face.

E-Cooperation is being accepted and expected not only in online learning but also in organizational training and meeting [14]. The practice of using small group settings in several software development activities creates a natural candidate for online collaborative meeting. Managers and employers can meet and share their work experiences with others seated away from them in an online environment [14]. Finally training and meeting in various geographical locations is costly, and many organizations might face decreasing budget and human resources [15].

When modeling traditional organizational collaborative meeting, it discloses similarities with the pattern definition. There are essential components that are contained within most meetings, such as *objectives*, *context* and *forces*. Figure 1 shows our modeling of an organizational collaborative meeting process. This process is described as an interactive flow. First, the process starts with the meeting *objectives* specified by the manager or session's facilitator. Then the meeting *context* is used to help facilitators select a collaborative activity. For example, in the context of a requirement joint problem-solving activity, negotiation can be viewed as attaining agreement on the assigned problematic requirement (requirement conflict, inconsistence, etc.

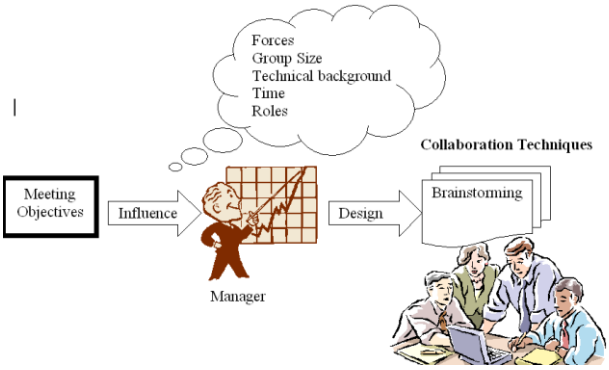

Figure 1: Modeling the cooperation process

The second component that affects the design of collaborative meeting activities is the environmental *forces*. The environmental forces according to this model are divided into three types: group size, time and technology. The group size is an important factor in choosing which technique to follow. For example, a debate activity is difficult to implement in a session with a very large group setting. The second type of force is time workload. Time workload plays a major role in design considerations, and it is often the most important factor for a facilitator designing a meeting session. The facilitator needs to know how much time and skill might be required in designing and facilitating the activity, and how much time participants would be required to spend on it. The third type of force is technological, which has two aspects, "tools", particularly which CSCW tools are available and "technical difficulty", which indicates how much time the participants would need to learn the tool. Then the facilitator needs to define the meeting agenda and upload any meeting needed resources.

According to the above process modeling, we can extend the Organizational Cooperation Pattern toward defining Organizational E-Cooperation Pattern (OECP) notation. We present in Table 3 an example on this notation that represent GNT pattern.

Table 3 GNT pattern

OECP	**GNT Group Nomination Technique**
Objective	to establish and encourage group decision-making on a specific issue that has many solution
Input	Topic or problem without a specific solution
Output	Best idea resolution
Context	Small groups of students with different skills and backgrounds interact collaboratively to create ideas and reach a resolution.
Session's Agenda (flow of session's steps)	1-a Session designer specifies the proposed project objectives. 2-Posting ideas, no criticism or elaboration is allowed in this step. 3-Discussing posted ideas to obtain clarification and evaluation. 4-Idea-prioritizing, each participant is asked to assign a mark for each idea. 5-Idea-reporting, reporting the highest idea **Step Actor Tool** 1 Designer Text chat, Audio, Video 2 Participants Text chat, Whiteboard 3 Participants Text chat, Audio, Video 4 Participants Voting tool, Text chat, Audio, Video 5 Chairperson Text Chat

The session agenda usually is defined as a sequence of steps (mini-activities), where each step contains at least an elementary activity, which in turn can be supported by a specific recommended tool in the run-time environment and performed by a specific actor. We believe that this way of breakage makes it easier to the facilitator to understand what type of communication tools is recommended to be used in each step and to guide a specific actor to engage properly in the specified step.

Usually, a real-life organizational meeting consists multiple patterns. For an example in the following technical quality review session, its agenda employs multiple collaborative patterns as shown in Figure 2. The following steps represent the entire session's agenda:

1. Download and read individually the documentation regarding the software product items to be reviewed.
2. Each participant privately writes down his considerations regarding specific product items.
3. Participants brainstorm within their group their concerns.
4. Participants vote on these issues to reach a resolution.
5. Participant review a checklist regarding past meeting's items that are accepted provisionally.
6. A final debriefing session to conclude all findings and resolutions.

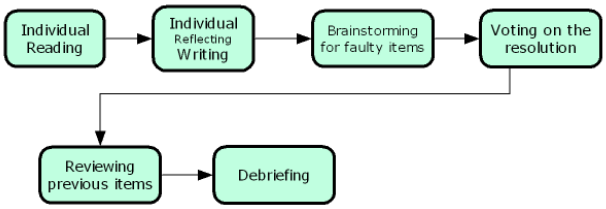

Figure 2: OECPs within a traditional technical review meeting

5. Implementation Organizational E-Cooperation

In this paper we also present a few applications that could be used to provide a proper environment support for OECP. In the past few years, a large number of applications have focused on providing Computer Support for Collaborative Learning (CSCL) [16]. Most of these applications started at universities and/or other research institutions. Their aim has been to solve the primary needs of supporting collaborative learning across different organizations and platforms. In this section we introduce some of these CSCL applications that could also be used as CSCW, such as:

- **Breeze**: This is a commercial software, originally produced by Macromedia and now by Adobe [17], as a rich web communication system that provides online meeting, cooperation, real-time web conferencing, and live presentations. Breeze enables instructors to easily create engaging communications that

include voice, video, and animations. Breeze has four main components:

1- Breeze Meeting: It supports large-scale meetings and small collaborative group meetings. It provides audio/video communication, application-sharing, and white-boarding.
2- Breeze Training: It provides online training. Instructors can use this product to deploy, track, and manage online courses.
3- Breeze Presenter: It allows designing of media-rich content by including voice annotation and insertion of polls and quizzes into PowerPoint slides.
4- Breeze Event: It manages learners' registration, qualifications, notification, automatic e-mail reminders, and tracking.

- **LAMS** [18]: This is an open-source software, developed by Macquarie University. The intention of LAMS is to enable instructors to design a sequence of learning activities for learners that includes content and collaborative tasks. LAMS provides session's designer with a set of collaborative tools that can be easily dragged and dropped to design sequences of collaborative tasks. It allows him to runs the sequence of tasks for participants and allows them to monitor and track their progress.
- **RELOAD** [19]: This is an open-source authoring environment, developed at the University of Bolton. Its main aim is to allow instructors to author learning designs based on activities. A single activity could be any form of learning activity, such as reading a learning material, collaborating with peers, visiting a museum, etc. The RELOAD Editor allows instructors to design a unit of study by sequencing learning activities in a simple format. In each step, instructors need to specify at least the task description. They can also include reading resources or communication service in each step. The RELOAD Player is used to run the design.
- **COLLAGE** [20]: This is a high-level specialised learning design authoring tool for collaborative learning, developed at the University of Valladolid, Spain. The COLLAGE authoring tool enables instructors to easily create potentially effective collaborative learning designs by particularizing and customizing some of the best practices in collaborative learning, according to the requirements and conditions of a particular learning scenario.

6. Conclusions

As many organizations are looking at online as the effective medium for virtual cooperative-based meetings, it is far more challenging than face-to-face meetings. There are many challenges to this type of meetings such as, missing the social-sense nearness found in face-to-face setting, requiring more time and effort from both session's facilitator and participants in the online environment and free-riding phenomena, whereby there is a few participants are doing all the work are typical challenges found in the informal sessions. Nevertheless, the online cooperative-based session will still grow more in the future, due to the development team expansion and partition which in turn increases the pressure on cost and time reduction.

This paper has introduced the idea of reusing e-learning cooperative patterns within organizational environment and how they could be supported. We also presented a specific example on the usage of these patterns within a traditional cooperative meeting.

We believe that there is a need to increase the awareness of such approach that focuses on reusing successful designs and formal processes rather than just tools to conduct successful online meetings.

Finally, we are looking forward toward a new generation of CSCW that enable sessions' designers to select, sequence, and implement OECP in a simple and direct manner.

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