CoPE: Democratic CSCW in Support of e-Learning

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Abstract

Computer Supported Cooperative Work (CSCW), and e-Learning have overlapping, but not identical design and use profiles. We suggest that democratically organized CSCW systems provide an ideal platform for organizing and encouraging group interactions in e-Learning situations where physical meetings are not feasible. Few attempts at democratic CSCW systems have been made, we argue, largely because the necessary development resources are concentrated in large hierarchical organizations which have little apparent use for such systems. The CoPE CSCW system introduced in this paper distinguishes itself by employing some of these methods to control how a document transitions through the system workflow. In a classic workflow example, draft documents may be commented upon in a given workflow state (deliberation and democratic participation); after the commenting period the document may move into a decision state during which a vote takes place to determine if the document will be approved or rejected (democratic decision). Democratic production of documents is related to the first characteristic, but focuses on the process by which documents are created rather than that by which they are accepted by a group.

Collaborative learning is an emerging paradigm dedicated to improving teaching and learning with the help of modern information and communication technology [2]. Democratic group-based support can facilitate both formal and informal learning, particularly increasing the efficacy of informal learning structures. Modern pedagogical approaches include advanced learning techniques based on some form of collaborative consensus-building mechanism, such as learning by discussion and problem-based learning [3]. Additionally, such mechanisms can substitute for the lack of a central knowledge authority common to informal groups such as non-technical students collaborating in small groups outside formal classes.

This paper focuses on the intersection between collaborative work (CSCW) [4], collaborative learning (CSCL) [5] and Document-Centric Democratic Collaboration and Production (DCDCP) to help small groups of learners with or without technical skills to enhance and improve the construction of effective knowledge [6].

Questions related to the application of DCDCP to small learning groups have been, to the best of our knowledge, hardly investigated. Software development efforts have been primarily focused on commercial applications for business customers. The primary efforts focused on enterprise-scale applications, although some projects were targeted to smaller groups such as small businesses or business units within larger organizations. Even those targeted at smaller environments, however, generally envisioned commercial users and none considered the type of democratic collaborative production and enabling of group formation that is needed in our research context.

At the beginning of our research, we conducted an initial application survey [Thaw thesis] as an attempt to examine ways in which communities with common interests have collaborated online in exchanging information or building knowledge repositories of some form. We examined a wide cross-section of interest groups that share information and benefit from collaborative learning. The composition of such groups ranged from online associations of networked
professionals, short-term collaborators on specific projects, businesses, hobby groups, and social exchange networks. Several factors with wide variance included: group size, duration of participation, proximity of individual participants, economic relationship between participants, and level of intra-group interactivity.

Our initial survey found little activity in group-based e-Learning of a DCDCM style. Thus we broadened our search and conducted a more formal review of the current state-of-the-art online collaborative systems most likely to operate in this space, either currently or that might develop in this direction in the future. While we found several approaches in this direction [4], [7], four essential characteristics in the DCDCM domain were missing: 1) democratic decision making; 2) democratic production of documents; 3) usability of the system by general users; and 4) customizability of the system by general users.

In this paper, an attempt to fill this gap is reported by introducing an innovative system called Communities of Practice Environment (CoPE).

2. Introduction to CoPE

The fundamental idea behind CoPE [8] is the result of both an inductive and iterative deductive investigation process. The inductive process began with democratic theory and CSCW first-principles as described in Section 1. From this initial loose specification we worked deductively based on our experience with several democratically-organized groups. Examples of these groups included an immigrant-support network, a interdisciplinary faculty at a university, an academic conference, and a technology-based education program for secondary school students. We envision this type of system enabling collaboration for other types of groups such as social workers, community action groups, public school teachers, and other sets of individuals who might benefit from the ability to organize and collaborate outside their traditional institutional structures.

CoPE is designed to enable a specific type of collaboration; a subset of CSCW that we argue has not been adequately addressed. Specifically, this involves sets of individuals who share a need or desire to engage in collaborative production. The object of this production is something that can be codified in documents. CoPE is targeted to individuals who do not already have a formal workflow for this collaboration or who are seeking to improve upon inefficient workflows. CoPE also envisions enabling collaboration among individuals who are part of organizations with formal collaboration mechanisms, but whose mechanisms are limited to intra-organization collaboration. Finally, CoPE is designed to enable collaboration, not management, and thus envisions “democratic” collaboration.

There are many examples of sets of individuals around the world who have a need or desire to collaborate but lack the resources, knowledge, or institutions to do so [9]. Consider, for example, public school teachers, social workers, and community action groups (where the group and its peer groups are the “individual”). Often these individuals are separated by geography and/or time. They could be too distant from one another to organize face-to-face meetings. They also could be unable to meet due to scheduling constraints or differing work hours. Such individuals may already be part of existing organizations but the “peers” with whom they wish to collaborate are in different organizations. CoPE is especially targeted to the individuals and organizations described here who lack substantial technical expertise or the resources to acquire such expertise. This includes any e-Learning situation for non-technical students.

3. CoPE development

In this section, we present the main guidelines that influenced the construction of CoPE. To this end, we first describe the user requirements that motivated its development and then we provide the main decisions made in designing the user interface. Finally, we discuss certain technology issues in building and supporting CoPE.

3.1. General requirements and analysis

CoPE was developed for the needs of a certain type of user forming the CoPE User Community. The system interface design makes assumptions based on the characteristics of such users. We call this type of user the “General User.” The following assumptions motivate this definition:

- users do not have specialized (information/computing) technical skills,
- users possess a basic skill set for computer and internet usage,
- users possess the ability to learn a new (information/computing) skill set of this same basic technical level,
• users are willing to learn a new (information/computing) skill set of this same basic technical level,
• users do not already share a sophisticated and/or long-used method for electronic collaboration.

We conceptually framed our target user from the characteristics of the sets of individuals for which we wish to enable group formation and collaboration. As described in Section 2, we employed both inductive and deductive methodology. We began by examining the types of collaboration we wanted to enable and the types of groups we wished to facilitate forming. This generated our first condition, that users did not have specialized (information/computer) technical skills. We then considered the constraint of assuming that individuals would not necessarily be using the same computer operating platform, thus requiring a platform independent system. This led to the selection of a web-based application and thus the second condition, an affirmative requirement that users have at least a certain basic set skills in computer and internet usage.

In conjunction with these early requirements and in order to both gather the specifics needs of our targeted audience and identify the lack of technological support to meet these needs, we deployed a series of test groups using then-current online collaboration tools. The collaboration tools were primarily designed for small-medium sized businesses or business units/groups within large organizations.

Our main test group was the California Central Valley Partnership (CVP). At the time the CVP group was comprised of an executive board of approximately 15 members who were leaders of public interest organizations for immigrants living and working throughout California’s central valley agricultural communities. The leaders of these organizations were substantially geographically dispersed, possessed varying levels of technical skill with information systems, and communicated in multiple languages. They had few face-to-face meetings.

Our experience with the CVP confirmed much of what we expected about the products available at the time. While likely effective for their target audience, the unique characteristics of the General User and the CoPE Community made it difficult for members of the CVP to effectively use the tool. Most notable in this early experiment was the difficulty users with less technical skill had in learning a system whose interface pre-supposed a higher level of technical skill than that which we ascribe to the General User. This steep learning curve provided a strong disincentive to members of the CVP, and thus our first test resulted in negligible adoption and no performance advantage for the organization’s activities.

Building on this experience and our own research, we began a requirements analysis. The CVP has remained a part of this process. As it possessed many of the characteristics of our target user base (i.e., the user CoPE community), we interviewed members of the organization, participated in some of their activities, and engaged in other similar ethnographic research methods. The results of this process were instrumental in development of our system requirements.

3.2. User interface design

The requirements above indicated that a friendly, easy-to-use interface was paramount. This is particularly true for individuals/groups characteristic of the CoPE User Community.

![CoPE Screenshot with Logged-in User](image)

**Figure 1.** CoPE Screenshot with Logged-in User

To this end, the basic template for the CoPE was designed following the web-based column/widget model of organizing collaborative workspaces, which has become quite popular in this context. We developed a three-column interface for CoPE, comprising a primary workspace column (center), which displays the current focus document; a navigation column (left), containing the primary tools for navigating the CoPE hierarchy; and, finally, a discussion column (right) to provide easy access to common workflow tasks and related information to facilitate ease-of-use of discussion. The votable items window appears at the bottom of the discussion column. There is also a standard header/control bar across the top (see Figure 1).

An essential element of the design was that it functioned on a single page, requiring neither
horizontal scrolling of the web browser nor multiple browser windows. This was primarily a usability decision; our participatory requirement process revealed that either change introduced substantial confusion to the General User. Surprisingly, however, vertical scrolling of the web browser did not. This was true provided that most/all of the users’ control buttons/links were visible from the initial browser view (top of page). Interestingly, users experienced less difficulty when text entry fields (e.g., for Comments) extended below the viewing area. Almost no difficulty was demonstrated when the display of a document extended below the viewing area.

Finally, it was crucial that both the navigation pane and the top header/control bars were fully visible at first viewing of any page. It is also important online documentation was always visible in the navigation pane. To this end, complete and detailed, easy-to-read user manuals for the different types of existing users (e.g., general members and coordinators) were made available in CoPE. We found this feature tremendously helpful to users in familiarizing themselves with the system and feeling comfortable when moving to a new feature/page of the system.

3.3. Implementation issues

Our review of the state of the art revealed that there was not then an obvious platform to support our system requirements. We experimented briefly with a hosted collaboration portal to get our first test group up and running and help develop system requirements. We quickly found that the system was too rigid in its design and too focused on commercial users to meet our requirements. Based on this analysis, we elected to pursue developing our own platform.

We began development of the CoPE system as an extension of the popular open-source web application platform Zope/Plone platform [10], [11].

Open-source projects that try to use the web for informal collaboration exhibit two characteristics that complicate their development. First, they lack the backing of a large, enterprise-scale hardware, operating, software, and security platform. Second, they require extended development times to reach even a first-iteration proof-of-concept since the work is, by nature, done in individuals’ “free” time. These characteristics further complicate development by forcing developers to divide their efforts between advancing the project and maintaining proper security within their application.

Furthermore, the physical infrastructure of the server and the network on which it resides must also be considered with respect to security vulnerability when opening access to CoPE to the public Internet. Many of the Internet-based electronic attacks are the result of flaws discovered by malicious users [12]. In theory, a security vulnerability in CoPE’s modification of Zope/Plone (or a similar vulnerability in Zope/Plone itself) could effect the application layers and result in a malicious user being able to execute code on the machine with privileged access.

4. Case studies supported by CoPE

We implemented the first “CoPE” as a single Plone instance on our Zope application platform. Since we were attempting to develop a platform that would meet the broad characteristics of requirements defined in sub-Section 3.1., multiple test groups were required.

To this end, we sought out groups that fit most of the CoPE User Community characteristics. These included an outreach program for students from local school systems, a small first-year section at a law school, an academic conference, and the faculty of multidisciplinary (both technical and non-technical) department at a major university. Our results from working with these groups were quite promising. Each represented a slightly different subset of each of the CoPE User Community characteristics. Since no “perfect match” groups were available, these more readily accessible groups were able to provide us with feedback and opportunities for iterative development with almost all the design elements in our requirements and specification.

The group with local school children comprised working with a program manager for the group and the students in the program. It was a natural fit to the CoPE Community coordinator/user roles. The program manager was the CoPE coordinator, and the students (and sometimes their parents) were the general users. While perhaps more technically sophisticated than some other users, the group was excellent for the “lack of preexisting collaboration utility” and “willingness to learn” characteristics of the general user.

The first-year law section was an interesting experience. As individuals, they possessed all the characters of General Users except one – the willingness to learn a new information/computing skill set. This lack of willingness was a function of the volume of work required of first-year law students; they simply lacked to time to learn how to use the system effectively enough to receive substantial benefit from it. The primary learning result of this experience was that willingness to learn was an absolutely critical
factor that could block an otherwise well-matched group from being able to use the system.

The academic conference provided our first real test of a fully (geographically) disparate group. With the exception of the conference itself, none of the participants met face-to-face. The experience was surprisingly successful. In part, this may have been due to the conference coordinators’ influence on directing participants to use the system prior to the conference. It may also, however, have been slightly biased as many (if not all) of the participants possessed a higher degree of technical skill than would a general user.

A similar logic applied to the academic department. The coordinator was the acting Chair of the department, and leveraged that position to encourage the members of the department to use the system. Again present was the secondary factor that many members of the group may have possessed higher technical skill. The heterogeneity of the group was an interesting aspect, however the testing period did not reveal any obvious insights into designing for such groups. This is an area that may warrant further inquiry.

5. Applying democratic CSCW to e-Learning

In this section we first suggest the main opportunities offered by DCDCM systems for the CSCL domain. We discuss the need of technological support for asynchronous interaction in on-line collaborative learning. Then, we justify the suitability of certain features of CoPE in this domain and finally we provide a brief introduction to a new project we have started to extend CoPE to specifically support collaborative learning and the analysis of student activity.

5.1. e-Learning and DCDCM systems

It has been understood for decades that, while lectures can be pre-packaged, there is no substitute for the interaction among students and teaching assistants in discussion sections. This has always been a problem for e-Learning, particularly where barriers of space and time prevent direct meeting.

Essentially any e-Learning system for students not in face-to-face contact must include some means to facilitate communication and interaction among students and instructors about the material. This requirement is the e-Learning analog of class “engagement.” While there any many ad hoc approaches to this task, a democratic CSCW platform such as CoPE seems ideally suited to provide a systematic mechanism for both student-student and student-instructor interactions.

There are several features of the implemented CoPE system that support e-Learning discussions. Most obviously, the facility for hierarchical threaded discussion of documents can serve as a core for group consideration of material of any kind. Through the hyperlink facility, this can include arbitrary additional material. One obvious paradigm is to have the instructor post a document for discussion and to also intervene in the ongoing dialog when appropriate.

The CoPE mechanisms also support the production of joint projects by subgroups of students. It is easy to set up subgroups so that the work of each group is kept private from the others, but is visible to the instructor. Of course, all of the interaction ability is also available to the subgroup. This potentially has an advantage over traditional methods of direct interaction in that the instructor has access to (much of) the process of the group’s effort and that this is well-codified for later review and use.

More recently, there has been wide spread use of interactive voting in the classroom. The basic idea is simple - a focused challenging (binary) question is posed to the class as part of a presentation of new material. There are several interesting variations on this theme. It is often useful to have small groups of students discuss the issue before voting. One can also use Delphi like techniques with repeated discussion and voting. This kind of classroom voting has proven to be quite successful and there is even a small industry providing electronic support for these techniques [13]. Of course, the voting mechanisms of a system like CoPE are ideally positioned to extend classroom voting to e-Learning. All of the alternative approaches to this pedagogical technique have natural realizations in CoPE.

Although, they have not been stressed in this paper, there are also mechanisms in CoPE that allow the coordinator of a CoPE site to customize much of the form and content of the material without programming. There is a coordinator's interface (and manual) that provides a range of choices on discussion and voting methods. Although this has not yet been verified, we believe that some variant of this functionality would enable instructors without IT expertise to customize their e-Learning discussion environments.

5.2. Extending CoPE to the e-Learning domain

We are currently working on an extension of CoPE to provide full support for both formal and informal
Learning groups of the CoPE User Community type by applying the democratic discussion and decision-making mechanisms of the CoPE system to existing e-Learning applications.

A fundamental requirement to sustain CSCL applications is the representation and analysis of group activity interaction to facilitate coaching and evaluation [5]. Interaction analysis relies on information captured from the actions performed by the participants during the collaborative process. To this end, fine-grained usage data and other complex information collected from the learners’ interaction are provided to give immediate feedback about others’ activities and about the collaboration in general [3].

In extending CoPE to e-Learning, therefore, a primary requirement is extensive management and provision of information and knowledge in terms of task performance, group functioning and scaffolding [14]. The ultimate goal is to enhance and improve group activity by constantly keeping CoPE users aware of what is going on in the system (e.g. others’ contributions, new documents created, etc.). In addition, monitoring participants’ performance in CoPE allows tutors to identify problems that participants may encounter during the assignments. These findings can then be used to provide both real-time and asynchronous support to students (i.e., help students who are not able to accomplish the tasks on their own).

By intersecting CoPE CSCW system and CSCL principles we expect to provide more opportunities to learning by discussion and collaborative learning in general.

As we said at the outset, Democratic CSCW and e-Learning have overlapping but distinct goals and operating environments. The ongoing efforts, such as the extension of CoPE to the e-Learning domain, to integrate ideas from both literatures promise to yield both new insights and resulting systems that improve e-Learning and hopefully CSCW in general.

6. REFERENCES