Transcending the Information Given: Designing Learning Environments for Informed Participation

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ABSTRACT

Informed participation is an approach for community-based learning and design in which all participants actively contribute toward the framing and solving of complex and multidisciplinary problems. Informed participants go beyond the information given to explore large problem spaces, learn from their peers, and create new understandings. Informed participation requires social changes as well as new interactive systems that provide the opportunity and resources for social debate and discussion rather than merely delivering predigested information to participants.

This paper describes courses-as-seeds as an application of informed participation to university-level courses. This application demonstrates key aspects of our approach and highlights direction for future research.

Keywords

informed participation; seeding, evolutionary growth, reseeding; social practices; open systems; evolving information repositories; courses-as-seeds, consumer and designer mindsets, knowledge management

INTRODUCTION

Cultures are substantially defined by their media and their tools for thinking, working, learning, and collaborating. Much of the new media is designed to see humans only as *consumers*, television being the most obvious medium that promotes this mindset and behavior [Postman, 1985]. Unfortunately, a "consumer mindset" [Fischer, 1998] does not remain limited to television, but in many cases extends to other activities and domains in our culture, including education and educational media. Our research interest is in designing the social and technical infrastructures in which *new forms of learning* [Bruner, 1996] can take place, including lifelong learning, learning on demand, self-directed learning, and collaborative learning [Fischer, 1999].

This paper addresses the ongoing enhancement and evolution of conceptual frameworks and information environments to support informed participation. We have explored this concept in several domains including (1) design and design environments [Arias et al., 2000]; (2) collaborative knowledge construction [Fischer & Ostwald, 2001]; and (3) courses-as-seeds and course information environments [dePaula et al., 2001]. Courses-as-seeds, an innovative approach towards embedding informed participation in classroom activities, will be used in this paper as our exemplary domain.

CONCEPTUAL FRAMEWORK

Informed Participation

Informed participation [Brown et al., 1994] is an approach for addressing the open-ended and multidisciplinary design problems that are most pressing in our society. These problems, which typically involve a combination of social and technological issues, do not have single "right" answers, and the knowledge to understand and resolve them changes rapidly, requiring an ongoing and evolutionary approach to problem solving. Our approach emphasizes "mutual learning" for sharing the unique knowledge that each participant brings to the design problem [Resnick et al., 1991], and evolution-based design approaches in which problem framing and problem solving are intertwined [Schön, 1983].

Participants form a *community of interest* [Fischer & Ostwald, 2001] made up of people from different backgrounds, all having a unique stake in a common problem. The roles of "teacher" and "learner" are not

fixed attributes of a person, but rather they are a function of a particular context. New knowledge is constructed when teaching and learning activities feed each other, ultimately producing a greater shared understanding than could be achieved by each of the participants on their own [Resnick et al., 1991].

Informed participation is impossible in communities in which most of the members regard themselves as consumers [Fischer, 1998]. Learners (acting as active contributors) must acquire a new *mindset* [Fischer, 1999]—they are no longer passive receivers of knowledge, but need to be researchers, constructors, and communicators of knowledge. Knowledge is no longer handed down from above (either from specialists in design, from managers in organizations, or from teachers in courses), but is constructed collaboratively in the context of work.

Informed participation is based on the fundamental claim that an important role of new media is to provide the opportunity and resources for social debate and discussion, rather than to merely provide access to predigested information. Media for informed participation must support the following functions that are often associated with *knowledge management* [Fischer & Ostwald, 2001]:

> *Creation and Capture.* As opposed to delivering existing information to users, systems for informed participation enable users to contribute their knowledge and expertise—thereby transcending *"beyond the information given"* [Bruner, 1973]. The goal is not to just accumulate information but to collaboratively construct new knowledge, leading to "living" information spaces.

> *Extension and Reuse.* The products of each project or design session extend the body of information relevant to the problem domain. The goal is not that the system will contain complete solutions to given problems, but rather that it contain resources that allow the participants to frame new problems and generate new understandings—to go beyond where they could have gone if they had started from scratch.

Information spaces supporting informed participation are large, open ended, and evolving [Raymond & Young, 2001] requiring a process model to enable sustained use without degrading quality and usability.

Seeding, Evolutionary Growth, Reseeding (SER) Model

The SER model [Fischer et al., 2001] is a descriptive and prescriptive model for large and evolving information repositories. The SER model postulates that repositories that evolve over a sustained time span must continually alternate between periods of activity and unplanned evolution, and periods of deliberate (re)structuring and enhancement. We have explored the feasibility and usefulness of the SER model in the development of domain-oriented design environments, organizational memories, and course information environments.. The evolutions of these systems share common elements, all of which relate to sustained knowledge use and construction in support of informed participation.

Seeding. A *seed* is an initial collection of information that is designed to evolve. It is created by environment developers and future users to be as complete as possible. However, a seed can never be truly complete due to the situated and tacit nature of knowledge as well as the constant change occurring in the environment in which the system is embedded.

Evolutionary Growth. The evolutionary growth phase is one of decentralized evolution as participants use and extend the seed to do work or explore a problem. During the evolutionary growth phase, participants are focused on solving a specific problem, rather than on creating reusable information. As a result, the information added during this phase is not necessarily integrated with the rest of the information in the seed.

Reseeding. Reseeding is a deliberate and centralized effort to organize, formalize, and generalize content created during the evolutionary growth phase. The goal of reseeding is to create an information space in which useful information can be found, reused, and built upon. Reseeding is necessary when evolutionary growth no longer proceeds smoothly. It is an opportunity to assess the information created in the context of specific projects and activities, and to decide what should be incorporated into a new seed to support the next cycle of evolutionary growth and reseeding.

APPLICATION DOMAIN: COURSES-AS-SEEDS

Courses-as-seeds [dePaula et al., 2001] is an educational model that applies informed participation and the SER model in the context of university courses extending beyond the temporal boundaries of semester-based classes. Courses are conceptualized as *seeds*, rather than finished products, and students are informed participants who play an active role in defining what they will learn [Rogoff et al., 1998]. *Evolutionary*

growth is driven by course work—discussions and projects that explore a problem or issue from a new perspective, building upon the work of a prior project or class, and the unique expertise and experience of the course participants. *Reseeding* is an opportunity to reflect upon the learning that has occurred in the past semester and to set the initial course for the next semester. Central to the courses-as-seeds model is the use of an information environment that enables each offering of the course to build upon the products of prior classes, as well as serving as a forum for class discussions and a workspace for projects.

DynaSites: Support for Informed Participation

We have developed the DynaSites environment [Ostwald, 2001] for creating and evolving web-based information spaces in support of informed participation. DynaSites provides discussion forums, persona pages for representing participants, glossaries, and an annotatable collection of information resources (web bookmarks and literature references). These individual information spaces are integrated by several linking strategies intended to make the information more useful and meaningful by connecting related pieces of information that otherwise would not be connected. For example, links are automatically created between occurrences of glossary terms, allowing users to easily find all the discussions in which a given term appears. Users are also able to manually create cross-links between information items, or from an item within DynaSites to a location on the Web.

Information spaces created with DynaSites are owned by the people and communities who use them to do their work, rather than by specialists, management, or teachers [Fischer & Ostwald, 2001]. DynaSites serve not only as repositories of information, but also as living mediums of communication and innovation that evolve through many small contributions made by many people rather than through large contributions made by few people [Fischer et al., 2001].

DynaSites was used to support a variety of courses taught at the University of Colorado (for examples see: http://www.cs.colorado.edu/~gerhard/courses/). These courses consisted of readings, discussions, independent research, and a semester-long project. Participants were given questions for each reading and asked to post their responses in a DynaSites discussion forum prior to the classes in which that reading would be discussed. Participants were encouraged to read the responses of their peers and comment on these responses. The projects used the forum to coordinate, communicate, and store their products.

The information space after a semester of evolutionary growth

Analysis of these information spaces (see [dePaula et al., 2001] for details) indicated several characteristics that limit their ability to inform future participants, including:

> Responses to reading assignments were almost invariably named with the default title (e.g., "Re: Assignment 7") offering future learner no clue of the contents of the entry;

> Discussion threads were shallow, indicating that participants did not engage in interactive exchanges but rather directed their responses toward the instructor;

> Individual entries were only rarely linked together using the linking functions provided by the DynaSites system and therefore failed to explicitly reflect the development of key ideas throughout the courses; and

> Potentially valuable information objects, such as web bookmarks and literature references, that might have been represented within the resource repository of DynaSites were instead embedded as plain text in the forum entries.

In summary, the content and structure of the information accumulated during the semester (corresponding to the evolutionary growth phase of the SER model) was meaningful to the course participants but not to learners who did not participate in its creation.

Reseeding - preparing for the next class

In terms of the SER model, *decentralized evolution* over the semester resulted in an information space that required *centralized integration*, such as the following processes to formalize information [Fischer et al., 2001]:

> *Restructuring*: altering the threaded discussion structure to expose hidden nuggets in the discussions.

> *Summarizing and indexing*: creating new entries to explicitly consolidate related topics, show the development of a topic over time, or link new information to information created in the past.

Representing information in a form that DynaSites mechanisms can exploit: if URLs and literature references contained in the discussions are formalized as objects within the DynaSites resource repository, then they can be more easily found, annotated, and referenced by future participants.

To limit the reseeding phase to simply restructuring the information space does not take advantage of the chance to reflect upon the aspects of the course that shaped the information space. Learning activities, supporting technology, and community organization should be seen as interdependent dimensions of informed participation that co-evolve throughout evolutionary growth and reseeding phases.

TOWARD A CULTURE OF INFORMED PARTICIPATION

A major goal of informed participation is to empower people to have as much control and ownership over their design processes as possible—but control and ownership require extra work. In courses-as-seeds, for example, reading and commenting on the postings of other participants requires effort beyond simply turning in a homework assignment, and formalization of information requires even further effort that is not seen as part of the original task especially within the traditional culture of education.

To make informed participation a reality, the efforts required must be lowered, and the perceived benefits of performing the extra work, raised. People are naturally hesitant to adopt and learn yet another communication technology such as DynaSites or to do additional work from which they may not personally benefit [Grudin, 1994].

In a culture of informed participation, participants will see formalization as part of their work rather than as an extra task. The first step in this direction is to provide time and rewards for the extra work. The next step is to identify and encourage members of the community who are interested and inclined to become *power-users* [Nardi, 1993]. These participants are willing to learn new mechanisms and can assume a leadership role within the community, helping others to see a benefit in formalizing and perhaps even helping them to learn how. The emergence of such roles is an indicator of informed participation.

It is unclear whether the need for periodic reseeding processes can or should be eliminated if the user community can establish a practice in which formalization is regularly performed. Certainly the frequency of reseeding can be reduced by the activities of power-users, but we believe that occasional reseeding will still be necessary and beneficial. To expect too much immediate formalization increases the overriding challenge for informed participation even further: namely to motivate participants to be interested and engaged in a collaborative venture.

CONCLUSION

Providing access to information is an important contribution of new technologies, but it is limited in covering the full range of human activities in such areas as design, collaborative knowledge construction, and courses-as-seeds. Without supporting informed participation effectively, we will not address one of the fundamental challenges facing education—to prepare students as contributors to the complex and changing world that awaits them.

Informed participation requires additional efforts from both teachers and students, as well as new skills and new attitudes. But this approach to collaborative working and learning is a critical skill for students to acquire in schools, since it embodies the skills that are desired in the real world [Norman, 2001].

Our future work will focus on setting the stage for informed participation, broadening our notion of reseeding from system development to design of the overall course culture, including the redesign of course activities, exemplifying the full use of supporting technology, and encouraging the development of power users.

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