Introducing Digital Case Library

John M. Carroll
The Pennsylvania State University, USA

Craig Ganoe
The Pennsylvania State University, USA

Hao Jiang
The Pennsylvania State University, USA

INTRODUCTION

Case-based learning is one of the major pedagogical approaches applied in formal and informal teaching and learning. This article introduces an interactive digital case library which supports a full range of case study activities, such as case authoring, browsing, and annotating. Digital case libraries differ from common digital libraries in that resources of common digital libraries usually come from centralized sources, which are provided by the owners of digital libraries, such as university libraries, or publishers who run those digital libraries. Furthermore, cases usually come from distributed sources (i.e., course instructors, students, or real-world practitioners). Many cases are developed as by-products of teaching practice. For example, an instructor creates several cases for the class he or she teaches, and after created, these cases can be used for many years or shared with other instructors. Most case libraries currently available, however, do not support case authoring in such a distributed manner. This causes a version of "tragedy of the commons" in that users do not have means and motivation to contribute to the resources of digital library, and hence the value of digital case library and benefits of using it will be impaired greatly.

One solution to this dilemma is to make the users perceive their contribution and authorship in explicit manners, provide convenient means enabling their contribution, and at the same time make the users experience the benefit of using the system. The interactive digital case library presented here plays two major roles. First, the digital case library is a Web application system, providing supports for participatory activities and case use; second, the system is a digital repository, collecting, storing, and retrieving cases. The idea is to provide services for community members to contribute and use what they have contributed. In this way, the value of the digital case library will increase and the community will be rewarded over time.

BACKGROUND

Case studies, or cases, are descriptions of a specific activity, event, or problem, drawn from the real-world of professional practice. They provide narrative models of practice to students and other novice practitioners. Cases incorporate vivid background information and personal perspectives to elicit empathy and active participation. They include contingencies, complexities, and often dilemmas to evoke integrative analysis and critical thinking. Cases are widely used in professional education: in business, medicine, law, and engineering (Williams, 1992), public policy (Kenny, n.d.) and public affairs (i.e., https://hallway.org). For example, the well-known Harvard Business School case collection includes over 7,500 case studies of business decision making (Garvin, 2003). Perhaps coinciding with contemporary recognition that all disciplines incorporate practice (and not merely knowledge), or perhaps just reflecting contemporary pedagogical concern with active learning and critical thinking, cases have become pervasive through the past decade. For example, the NSF-supported National Center for Case Study Teaching in Science includes many case studies in medicine and engineering, but also environmental science, anthropology, botany, social and cognitive psychology, geology and geography, pharmacy and nutrition, and experimental design (Herreid & Schiller, 2005).

The focus on authentic learning activities is based on the hypothesis that learning outcomes will be enhanced if the activities students engage in, and the materials they use, more directly reflect the social and technical

contexts of actual scientific and professional practice in all domains, that is, business, medicine, software engineering, and nature sciences. Realistic activities and materials are more intrinsically motivating because they constantly remind learners of the possibilities for meaningfully applying knowledge and skills in the world beyond the classroom (Dewey, 1933). Today, many computer and information science and engineering (CISE) educators are working to develop and/or acquire realistic instructional activities and materials for their teaching.

One of the anatomy and physiology cases from the National Center for Case Study Teaching in Science describes the story of a doctor examining a young child with a chronic cough and diarrhea (http://www.sciencecases.org/cf/cf.asp). The story describes the interaction with the parents as the clinician presents a diagnosis of cystic fibrosis, and explains what this means for their child. This is accomplished in a mere 735 words. Immediately after the story, there is a list of seven questions that students are encouraged to answer as if they were clinicians interacting with the parents. Answering the questions requires going beyond the information presented in the case study; students working on this case use the Internet and physiology textbooks to develop their answers.

Prior investigations of case-based learning in CISE disciplines have been quite encouraging, primarily in the arena of professionalism and computer ethics (NSF DUE, 2006). Case-based approaches have also been developed and explored in more technical CISE topic areas, such as computer graphics (Shabo, Guzdial, & Stasko, 1996), design (Guzdial, Kolodner, Hmelo, Narayanan, Carlson, Rappin, et al., 1996), ubiquitous computing (McCrickard & Chewar 2004), and usability engineering (Rosson, Carroll, & Rodi, 2004a, 2004b). This research has also provided evidence that case-based learning promotes key metacognitive skills, including cognitive elaboration, error management, reflection, self-regulation, and transfer of knowledge (Carroll & Rosson, 2005a, 2005b; Kolodner, Owensby, & Guzdial, 2004).

Teaching and learning in CISE disciplines are demanding with respect to technical knowledge and skill in mathematics, programming, and system architecture, as well as with respect to professional skills in problem solving, teamwork, project management, professional ethics, and values. Recent innovations in CISE curricula and educational infrastructures have focused on better integrating these two types of skills through more "authentic" learning activities. For example, team-based projects are pervasive now in undergraduate and professional CISE education programs (Dietrich & Urban, 1996; Hartfield, Winograd, & Bennett, 1992; Hayes, Lethbridge, & Port, 2003; Lamancusa, Jorgensen, Zayas-Castro, & de Ramirez, 2001). These projects frequently incorporate a range of realistic activities such as requirements interviews, software design, and testing. These are sometimes quite extensive, spanning several weeks, even an entire semester.

MAIN FOCUS OF THE ARTICLE

Although the success of educational digital libraries ultimately depends on users contributing content, current educational digital libraries do not provide effective incentives or end user authoring support for categorizing content via standard schemas so that contributed content can be retrieved effectively (Marlino, Sumner, Fulker, Manduca, & Mogk, 2001). This is a version of the "tragedy of the commons" that afflicts many collaborative resources (Grudin, 1988). Furthermore, cases are narrative models of real-world situations, and therefore new cases should be able to be added into case library, if it intends to reflect various situations and new practices. To address this issue effectively, users must be able to perceive that their efforts benefit them in the immediate term, and be willing to contribute.

Another issue is about transforming a passive way of learning to an active one, in terms of using cases. Examples of case libraries can be found at National Center for Case Study Teaching in Science (http://ublib.buffalo.edu/libraries/projects/cases/case.html). Most of the case libraries do not support any interaction beyond browsing. One of the advantages of a case study is to provoke critical thinking, and the effect of learning will be amplified if users can engage with one another. Imaging a case study scenario in a classroom setting where students are given a case with several questions; if the students can engage with one another, and share their ideas and criticisms, they will learn more than in a solo-working situation where each individual digs into the case alone.

Requirements for Case Library

There are basically two categories of functions presented here: interactive functions that support user interaction and managerial functions that deal with administra-