Collaborative Authoring of Walden's Paths

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Abstract. This paper presents a prototype of an authoring tool to allow users to collaboratively build, annotate, manage, share and reuse collections of distributed resources from the World Wide Web. This extends on the Walden's Path project's work to help educators bring resources found on the World Wide Web into a linear contextualized structure. The introduction of collaborative authoring feature fosters collaborative learning activities through social interaction among participants, where participants can coauthor paths in groups. Besides, the prototype supports path sharing, branching and reusing; specifically, individual participant can contribute to the group with private collections of knowledge resources; paths completed by group can be shared among group members, such that participants can tailor, extend, reorder and/or replace nodes to have sub versions of shared paths for different information needs.

1 Introduction

It has been widely accepted that collaborative learning brings about a lot of improvements on human learning activities. For instance, Koschmann argued that human learning activities occur in social context where knowledge transfer takes place among social interactions [1]. Additionally, Scardamalia and Bereiter proposed that the central role of learning activities lie in facilitating learners' knowledge building process, where learners take the initiative to explore new knowledge [2]; therefore, a collaborative knowledge building environment promotes knowledge sharing, learning enthusiasm and critical thinking. Finally, Slavin claimed that learners from a learning group aiming at the same learning objective tend to be active in information exchange, creative thinking and take efforts on collective problem solving [3]. In order to facilitate this kind of progressive educational pedagogy new techniques are needed.

P. Zaphiris et al. (Eds.): TPDL 2012, LNCS 7489, pp. 461–467, 2012.
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1.1 Walden's Paths

Walden's Path [15] organizes resources on the World Wide Web into a linear ordered, contextualized data structure. A path is composed of ordered list of nodes that constitutes a resource URL, annotation and resource name. The World Wide Web could be viewed as a tremendously large collection of knowledge resources, with a range of media types like html, video, images, text and so forth. However, these resources are loosely linked into a highly complicated hypertext system; its dimension and size makes it more difficult to retrieve and organize to appropriately meet users' information requirements. The authoring of a path is the process of tailoring and filtering the resources from a large set of collection into a path with a specific topic. The path authoring of a path is a process of knowledge recreation, where each resource on the Web is evaluated, annotated and encapsulated into a node; the nodes are organized into a contextual knowledge artifact. Currently, authors of a path can reinterpret and comprehend the resources during the creation process and a path can be shared to other viewers who can traverse nodes in a path, where a learning process can be performed. However, to full embrace the knowledge building paradigm, the system needs to be redesigned with collaboration in mind. It is this goal that we have designed CoWPaths (Collaborative Walden's Paths) to address. Before delving further in to the motivation of our work we'd first present a quick overview of applicable work in pedagogy and in collaborative educational systems.

2 Prior Work

This need for new techniques to support knowledge building in many ways drives the introduction of computer technology to education and has brought profound impacts on the development of collaborative learning along with it. Specifically, computer supported collaborative learning improves the pattern of social interactions, knowledge construction and information sharing among learners. Researchers from different academic backgrounds have been extensively studying the computer supported collaborative learning from multiple perspectives, and found fruitful results. Liaw *et al.* found that students first take positive attitudes toward web based collaborative learning environment; then, individual learning performance improves as the group activities increases [4]; that is, active participation of high quality social interaction, such as opinion sharing, discussion, questioning and explanation, benefits the learning outcome of the group in general. Dewiyanti conducted observations and evaluations on learners' learning activities in web based collaborative environment with asynchronous communication provided [5]; her research found that group awareness among members is an vital prerequisite for successful collaborative activities where participants needed to be kept up to date with the status of group and peer activities in order to self-coordinate future group activities [5]. In the process of social interactions, participants can perform knowledge transfer through the communication cycle of questioning, explanation, interpretation, elaboration and evaluation. According to Balester *et al.*, the foundation of knowledge transfer is the differing levels of prior knowledge among participants and the mutual understanding of the reciprocal

benefits of this interaction [6]. Additionally, Warshuerer showed that effective communication yields knowledge retention for longer periods [7]. Finally, active contextualization of knowledge into discussion and critical thinking helps people in longer-term memorization [8, 9].

The emergence of computer supported collaborative learning has brought advancement of computer technology to the study of pedagogical approaches. The central research topic focuses on the collaborative construction and sharing of knowledge and communication technology supporting effective social interaction. According to Stahl [10], collaborative learning is a dynamic process [11], where knowledge is initially constructed individually, this is called personal knowledge building; then, knowledge is transferred and shared among group members with social interactions, such as questioning, brainstorming, interpretation, explication and evaluation. It is during this process of social interaction that collaborative knowledge construction occurs. The creation of knowledge artifacts serves to persist the group's knowledge and enhances the later knowledge acquisition by individuals. Currently, a wide variety of synchronous or asynchronous communication technologies are available for social interaction, such as videoconferencing, email, discussion, and instant messaging [12].

3 Use Cases

From our prior observations and the literature on collaborative learning, we have identified two major use cases, each with two sub-cases that provide a refinement on the more general case.

3.1 Group Authoring (Extension and Modification)

Easing group authoring has been a sought after feature of our users. Authoring as a group in the past was handled in one of three means. Some users would create a shared account that each member would have access to. This allowed them to author paths but without any record of who made which changes. The second means was by having group members clustering around a single machine and working together. Again no history was maintained and this required synchronicity. The only advantage this mode had over shared accounts was that changes were made with a consensus and conflict over changes was minimized. The third way in which users re-shaped Walden's Paths to allow collaboration was by utilizing the path import and export features. In this mode, users would export a path when their revision was made and then transfer the file, typically over email, to other group members who would make their iterations and share the results again. This allowed a history to be obtained through the email records and allowed asynchronous work but required users to leave the system and manage the collaboration themselves.

Instead we seek to allow users to perform these collaborative activities that they are already trying to perform with greater ease and without the drawbacks of some of the other means they are currently using. Authoring is essentially two sub-cases, regardless or if it is collaborative or not: extension and modification. Extension is the

addition of new nodes to a path. This is the most basic authoring activity as even the original path creation is an act of extension from the null path (the path without any pages). For this case the scenario is imagined as follows:

> *Peter and Valentine are preparing a path on current foreign policy issues between the United States and Russia for a project in their political science class. Peter initiates the creation of the path on his computer by adding a series of news articles on the current round of arms reduction treaties. After completing the path, Peter shares the path to a group that he and Valentine have access to. Peter indicates that other group members can extend the path. Later, Valentine on her machine logs and sees a new path in the group; she views the path and decides to add in a number of articles about Putin's election. In the group interface, she selects edit and can then add new pages to the path. She cannot change the path, as Peter did not grant modification privileges. Finally, Peter logs back in and see that his path has been updated and views the history to see that Valentine added a number of pages to it.*

In this example, the users can add new pages but not modify existing ones; this leads in to the other sub-case, modification. Modification allows the alteration of existing pages created by others. Similarly to the first subcase the second is imagined as the following:

> *Peter and Valentine's path has grown considerably and Valentine has called question to the order of the pages, the wording of some of the annotations and if one of the pages truly belongs. While Peter had been addressing her issues himself previously, he now decided that he trusts Valentine to let her edit the pages he has created. He then gives the group the modification privilege. The next time Valentine logs in to the system she notices that one of the articles is now pointing to a dead link. She finds an apt replacement and instead of sending the information to Peter in a comment on the path, she now has the ability to edit his pages in the editing interface.*

3.2 Future Reuse (Duplication and Adaption)

The second major use case is that of future reuse. In the past a path could be reused either in its entirety, by requesting an export from the author of the path, or via the duplication feature in Walden's Paths. However, duplication could only be done by the account that owned the path and the duplicated version could only be edited with that account. One group of users in the atmospheric science used a combination of a shared account and duplication to facilitate their reuse scenarios. These users were teaching assistants in a lower-level atmospheric sciences class. They used Walden's Paths to point students to self-study materials with some annotation to help guide their study. The class was offered in multiple different versions with altered curriculums and student populations. In order to tailor the canonical path that was authored collaboratively, each TA would copy the path and makes changes to suit her particular version of the class. When a new semester started the TAs would then repeat the same process of duplication and modification to make the path for the new semester. However all of these path versions were still reflecting an original that the new versions

were not tied to. To help this kind of use we seek to allow duplication of paths between accounts and the adaptation of paths while maintaining the ties back to the original path. For this case we imagine another scenario building off the prior two:

> *Weeks after the assignment, Valentine and Peter are preparing to independently write research papers for their Political Science class. Valentine is writing about the interplay between President Obama and President-elect Putin. Peter is writing about how the arms negotiations and American foreign policy has affected the Russian election cycle. Both of them want to use their shared path as a basis for their research. Each of them seeks to focus and extend the path for their particular topic. Peter therefore turns on the adaption permission and both Peter and Valentine select to adapt the existing path from which they can make their changes while preserving the ties back to the original version which still exists unchanged. A third student in the class, Andrew, is writing his paper on US politics around Arms Control. Peter tells him of her path. Upon viewing her adaption, he sees the reference back to the original path which he decides he wants to use as the starting place for his own work. He asks Peter is he can have his own copy. Peter not wanting Andrew's path to be explicitly tied back to his, grants public duplication privileges. Andrew then can duplicate the path and edit it as it was his own.*

One thing to note in this last use case is that privileges can be granted at multiple levels. Andrew's duplication was a public level permission while Valentine's adaption was at the group level. With these use cases in mind, we will now turn to our implementation of these scenarios.

4 Implementation

This section introduces the implementation and design for the collaborative authoring prototype. The goal of the tool is to provide a shared workspace that supports collaborative knowledge building, management, retrieval and sharing; at the meantime, asynchronous communication is provided in a form of contextual annotation and discussion. Local annotations allow users to annotate on any positions of the web pages in a path, which could be shared with, rated and commented by other users; therefore, local annotation feature provides an approach of social interaction and enhancement to knowledge building and information exchange. Group definition is proposed to facilitate collaborative authoring and social interaction; it includes four sections: group description, group knowledge repository, notification and group awareness visualization. Group description presents the group abstract of current group, introducing the group task and background information, group owner and group members. Personal notification customizes the most recent communication updates and pushes to each individual personal notification area to help maintaining individual active social interaction status. Specifically, new notifications include the following information: new annotations on knowledge page, unread discussion thread and reply, unread personal messages and group wise broadcasting message. Group awareness captures group status data, visualizes and delivers to group members. The data are extracted from two information sources, shared workspace status and group member

activities. Group awareness includes group knowledge construction history and social interaction records. Specifically, all group-wise activities are recorded and visualized in a timeline ordered by timestamp sequence. These activities include page construction, modification, deletion, task modification, participant comments and annotations. From the activity visualization, members can keep track of the evolution of the shared workspace and maintain awareness of participants' recent activities and contributions. Besides, group awareness visualization achieves knowledge persistence by scripting interaction history. Knowledge transfer occurs in the course of social interactions among group members; therefore, longer knowledge retention can be achieved by scripting communication history for later viewing and reference.

5 Conclusions and Future Work

In summary, this paper presents a prototype design for a collaborative authoring tool for users to co-author Walden's Paths This prototype can be tailored as a collaborative learning tool for students to perform active collaborative learning in groups, where participants join in groups to accomplish group wise learning tasks. The collaborative creation of paths is a process of knowledge recreation, where participants perform knowledge exploration, knowledge filtering, contextualization, reinterpretation and evaluation. We believe that CoWPaths helps the active learning process by allowing member communication. Group members can initiate an asynchronous communication channel by creating annotations on resources created by other. This allows social interactions among group members, in which knowledge transfer is achieved. Users can also bookmark annotations to keep track and record valuable content in the course of collaborative authorship. A path can also be shared and reused by other users, including the extension or branching of the original path. Such customization allows for more flexible path creation and resource sharing.

By introducing Walden's Paths concept into the realm of computer supported collaborative learning, we open up further work. Our next step will be to evaluate the benefit of our approach for collaborative learning by observing students' learning behaviors in collaborative settings and identifying the differences between collaborative learning and independent learning.

Acknowledgements. Walden's Paths is being developed as part of the Ensemble Computing Pathways Project. This work has been funded in part by the National Science Foundation under grants DUE-0840715 and DUE-1044212.

This document was prepared by Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, Tennessee 37831-6285; managed by UT-Battelle, LLC, for the US Department of Energy under contract number DE-AC05-00OR22725.

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