

Evaluating the Implementation of a Social Bookmarking Activity for an Undergraduate Course

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Abstract

This manuscript describes an exploratory study of a social bookmarking activity in an undergraduate course for pre-service teachers. During a 10-week activity, students were required to post links to Internet resources relating to course objectives and also to rate the content posted by other users. The analysis of data from this activity includes descriptive data regarding usage of the software system as well as descriptive analyses of users and non-users of the social bookmarking web-based application. The results of the study provide additional insight into trends of user behavior and a basis for possible modifications to the web-based system and the course activity.

Introduction

Although the term “Web 2.0” is no longer new and many of the Internet-based services and applications that fall under the Web 2.0 banner have already become nearly ubiquitous for many Internet users, there remains an ongoing effort to incorporate these tools into teaching and learning in a meaningful way. While “Web 2.0” is often described by abstract phrases such as “the Web as platform” or statements such as “the Web of documents has morphed into a Web of data” (MacManus & Porter, 2005), Web 2.0 is inherently challenging to describe. By whatever name or phrase is used to describe Web 2.0, it is the change in the way Internet users interact with each other and with content, information, and ultimately knowledge that has excited both business and educational ventures into finding new and innovated ways to take advantage of the collective and collaborative efforts of Internet users.

It has been stated that “ultimately, the label ‘Web 2.0’ is far less important than the concepts, projects, and practices included in its scope” (Alexander, 2006). Nowhere is this more applicable than in the discussion of Web 2.0 technology in education which has centered on the transformation of students from “content consumers” to “knowledge contributors.” Within the context of education, Web 2.0 is often termed the “read/write web” to emphasize the use of these technology tools to develop learning environments in which the students themselves are shaping the learning experience. Using a variety of Web 2.0 tools such as wikis, blogs, and various social interaction websites, students are becoming contributors to the World Wide Web rather than simply information consumers.

It is the focus of this paper to investigate the academic applications of a social bookmarking system and begin to explore the options for evaluating the impact of these activities on student learning. The concept of social bookmarking is that many users locate online content they have determined to be valuable in same way and contribute links to these resources to a website where they are shared with other users with similar interest. This idea is often extended to provide options for users to categorize, rate, and comment on the resources contributed by other users. Like many other Web 2.0 technologies, users are contributing to the overall collection either through the initial posting of the resource or through rating and commenting features. This paper describes an exploratory pilot study of the implementation of a social bookmarking application in an undergraduate course for pre-service teachers. In evaluating the social bookmarking activity, this study specifically focuses on (1) understanding common usage patterns within the social bookmarking application and (2) exploring options for determining the impacts of this activity on outcomes relating to course objectives.

Relevant Literature

Among the most well-known examples of Web 2.0 technologies are weblogs (blogs), wiki sites, and media sharing sites. In their most basic form, these tools are simply a mechanism by which users can create and make information and media available on the World Wide Web. However, this capability is not necessarily new. One of the distinguishing characteristics of Web 2.0 technologies is the interactive nature of the user contributions. For example, in the “old way” of web publishing, a user could post a web page for which they would write about a topic of interest. This may require specialized web publishing software and require a higher level of technical expertise. In the “Web 2.0” way of web publishing, a user with little technical knowledge can use free web-based tools to write about a topic of interest and interact with a growing social network of others interested in the same topic. Web publishing is no longer a one-way presentation tool and no longer limited by the technical expertise of the content author. Using the most common tools such as blogs and wikis, early adopters of these Web 2.0 technologies in education have expanded the learning environment to include a worldwide audience. These tools have enabled educators to develop a learner-centered environment with relative ease.

With regards to social bookmarking, a growing number of articles have been published describing the possible uses and benefits of social bookmarking in academic environments, though very few research studies have currently been published. Lomas (2005) describes the basic process of social bookmarking as “the creator of a bookmark assigns tags to each resource, resulting in a user-directed...method of classifying information” (p. 1). He further describes the social aspects of the process:

Users can also see how many people have used a tag and search for all resources that have been assigned that tag. In this manner, the community of users over time will develop a unique structure of keywords to define resources—something that has come to be known as a “folksonomy.” (p. 1)

Among the key principles underlying social bookmarking are (1) information is user-contributed with little or no editorial oversight, (2) users are share a common interest, and (3) the value of the activity exists in connecting with other users to develop a more robust and/or relevant collection

of resources. In its most basic form, social bookmarking is a new way of organizing the mass of information and resources available on the Internet by collaborating and sharing with other users.

With the emphasis on contribution and collaboration, the possible educational benefits of social bookmarking and other Web 2.0 technologies has certainly been noticed by educators. Online services at the University of Pennsylvania (<http://tags.library.upenn.edu/>) and Harvard University (<http://h2obeta.law.harvard.edu/home.do>) are incorporating social bookmarking technologies to enable both student and faculty research projects to extend beyond the existing classroom to connect with a larger social network both inside and outside an academic institution. Chudnov et al. (2005) describe the development and implementation of the Unalog system at Yale University. The Unalog system incorporates the basic principles of social bookmarking by allowing users to post links to any Internet resource along with “tags” used for categorization of resource and comments. One additional feature of the Unalog system is the ability to make information posted to the site either public or private and also the ability to share resources with user-created groups.

In addition to larger institution-wide systems, existing social bookmarking platforms have also been highlighted for their educational possibilities. Boss and Krauss (2007) describe the use of the social bookmarking website Del.icio.us as a tool for use in problem-based learning (PBL) activities. In an article by Hargardon (2007), a K-12 teacher describes the benefits of the social bookmarking platform Diigo (www.diigo.com) as helping to “[ensure] that students actually read, understand, and comment on” (p. 48) the resources that they locate. Shifflet and Toledo (2008) note that one of the more practical aspects of social bookmarking tools is the ability to access stored bookmarks from any Internet-connected computer rather than relying on bookmarks stored only on a single computer.

There remains, however, a scarcity of published research on the uses and impacts of social bookmarking tools. In one descriptive study, it was found that students were likely to meet the minimum requirements of posting and reviewing sites posted to the social bookmarking site, though most did not exceed these requirements to any large degree (Abbitt, 2007). Responses to a survey, however, indicated most students believed they had found resources they would use in the future. Also, nearly all of users indicated that the social bookmarking activity enabled them to find resources relating to teaching they would not have otherwise encountered through coursework or other means. In a study with graduate students, Coutinho and Bottentuit (2008) found that the many of the users described a social bookmarking activity using terms such as “collaborative,” “organized,” “available,” “useful,” “shared,” “practical,” and “easy,” thus highlighting the more popular facets of social bookmarking tools as well as Web 2.0 tools in general.

The impacts of Web 2.0 technologies in the field of education will be noticed in both traditional classroom teaching practices as well as technology-enhanced and distance learning environments. With the possibility of moving from an information transmission model of teaching and learning toward a dynamic, integrated, and inquiry-oriented environment, Web 2.0 tools, such as social bookmarking systems, emphasize the collaborative nature of learning and inquiry. While social bookmarking has become a unique social and technological phenomenon, the research and development of unique learning environments that effectively integrate these tools into the process of teaching and learning will require careful evaluation if these tools are to be more than simply the latest educational technology fad. Social bookmarking is often noted as

a valuable tool for teaching and learning (Abbitt, 2007; Abbitt & Odell, 2007; Alexander, 2006; Boss & Krauss, 2007; Bull, 2005; Chudnov et al., 2005; Coutinho & Bottentuit, 2008; Eastment, 2008; Farkas, 2008; Gordon-Murnane, 2006; Hargardon, 2007; Lomas, 2005; Madden & Fox, 2006; O'Hear, 2006; Shifflet & Toledo, 2008; Thompson, 2008). However, the majority of published material simply describes ideas on how to use these tools and does little to investigate the possible benefits of these activities on teaching and learning.

Methodology

It is the objective of this study to continue the investigation of user behaviors within a social bookmarking system and also to investigate options for evaluating the impacts of this activity on learning outcomes and course objectives. This pilot study includes descriptive analyses that provide insight into the overall use and potential benefits of the social bookmarking activity as well as implications for the future revision of both the activity and web-based system.

Description of the Social Bookmarking System and Activity

The social bookmarking activity was developed as a supplement to the curriculum of a course for pre-service teachers focusing on the integration of technology into K-12 teaching. During the 10-week period of a 16-week course, students were required to locate and post links and descriptions of web resources relevant to course topics to an Internet-based system designed specifically for this activity. In addition to contributing content to the site, students were also required to rate the items posted by other users by casting either a positive or negative vote. For the purposes of the course assignment, students were required to post a minimum of one new item each week and rate two items posted by other students. Participation in the social bookmarking activity occurred outside of the in-class sessions.

The screenshot shows the main display of the Technology for Teaching website. The header includes the site name "Technology for Teaching" and the URL "www.techforteaching.org". Navigation links include "Home", "Logout", "Submit a new link", "My Votes", and "My Posted Sites".

Topics

- All Sites (637)
- Tech Integration Ideas (291)
- Ed Tech News (97)
- Lesson Planning (340)
- Teaching Strategies (291)
- Ed Tech Research (100)
- Software Tutorials (47)
- Curriculum Resources (262)

My Stats

Last Login	2008-07-23 14:03:00.0
Total Logins	72
Total Posts	4
Posts in last 7 days	0
Total votes	4
Votes in last 7 days	0

All Sites

Sort By: [Posted This Week](#) | [Popular](#) | [Most Votes](#) | [Newest](#) | [Oldest](#) | [Recently Viewed](#)

Vote: [Ohio Academic Content Standards](#)
 Not a supplemental website for teachers to use for planning or instruction, but a basic and essential source for teachers that provides easy access to Ohio academic content standards in all subject areas
 Posted on: 11/1/2007 by Mallory Kraft

Vote: [Right in Class](#)
 This site is for educators seeking knowledge and tools to help plan for, create, and integrate technology "right in class".
 Posted on: 10/18/2007 by Dana Benzowski

Vote: [Are You Smarter than a 5th Grader Quiz](#)
 This is the website for the Fox TV Show: Are you Smarter than a 5th Grader?. On this site kids become the "contestants" and answer questions in varolius subjects.
 Posted on: 11/1/2007 by Jamie Schick

Vote: [Teaching Today](#)
 Provides lots of links about alternative assignments like digital portfolios, as well as more basic information like how to create a website.
 Posted on: 9/27/2007 by Bethie Karno

Figure 1. Main display of user contributed content

Access to the social bookmarking system was restricted to students enrolled in three sections of the course, and users were required to login to access the list of content items and to submit new items. Upon a successful login, users were presented with a list of the topics built into the system derived from course topics. After selecting a topic, users could view a list of content items in that topic and also use various filtering and sorting options to adjust the listings based on their preferences. The default view of the content items would display items posted in the past seven days sorted by a “popularity score.” The popularity score was a sum of the number of votes an item had received and the number of recorded visits by users.

All items available in the system were contributed by students in the course. Users posted new items using a web-based form that required a title, URL, and description of the item as categories to which the items should be assigned. Upon submission of a new item, the system checked for duplicate URLs already posted by other users and returned an error message when a duplicate was found.

Post Link to New Article

Title:

URL: Please copy/paste the COMPLETE URL from your web browser including "http://"

Description:

How did you locate this resource?

Internet Search Engine (e.g. Google, Yahoo)
 Browsing from another article posted to THIS site
 Browsing from another site I found on my own
 University online library resources (e.g. Ebsco search, etc)
 Site listed in a textbook
 Referral from another person
 Other:

Please rate the quality of this resource

Poor Outstanding

 1 2 3 4 5 6 7 8 9 10

Please select the grade level to which this resource is most applicable

K-5 All K-12
 6-8 Higher Ed
 9-12 Not Applicable

Select all appropriate topics for this article:

<input type="checkbox"/> Tech Integration Ideas	<input type="checkbox"/> Ed Tech Research
<input type="checkbox"/> Ed Tech News	<input type="checkbox"/> Software Tutorials
<input type="checkbox"/> Lesson Planning	<input type="checkbox"/> Curriculum Resources
<input type="checkbox"/> Teaching Strategies	

Figure 2. New content item form

Rating of content items was conducted through a simple positive or negative vote mechanism. Users would click on a green arrow pointing up to cast a positive vote or a red arrow pointing down to cast a negative vote. In order to discourage voting on items based solely on the

title and description, voting on an item was permitted only when a user had clicked on the link to that item before voting.

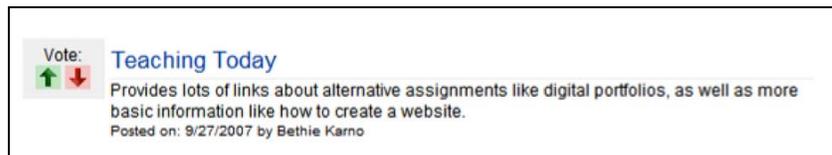


Figure 3. Sample content item display

Data Collection

Data were collected through two mechanisms. System usage data was collected automatically by the social bookmarking website that included information such as date/time of logins, page views, mouse clicks, etc. A survey was administered at the beginning and end of the course that included focused open-ended questions that asked students to list internet resources relating to two specific course objectives.

To facilitate group comparisons, students from three sections of the course participated in the social bookmarking activity as well as completed the pre-test and post-test surveys. Students from the remaining three sections did not participate in the social bookmarking activity but did complete the pre-test and post-test survey. Two instructors taught the six sections of the course. One instructor taught the three sections of the course that used the social bookmarking activity, while a second instructor taught the sections that did not use the system. The course content for all six sections was similar and was designed to follow the National Educational Technology Standards for Teachers (NETS-T). Completion of the pre-test and post-test surveys was voluntary for students in all sections of the course. Prior to the beginning of the study, all procedures were approved by the Institutional Review Board.

Participants

In order to examine usage of the social bookmarking system, data were collected from 61 students enrolled in three sections of an undergraduate course that used the social bookmarking system for the 10-week period. Forty-three (70.5%) of these participants were female, and 18 (29.5%) were male.

For the comparative analyses, student in all six sections of the same course were invited to complete a survey at the beginning and end of the course. Sixty-five participants completed both the pre-test and post-test survey including 42 respondents from sections that used the social bookmarking system and 23 respondents from sections that did not use the system. Most of these participants were female (83.1%) while 16.9 % were male. The age of participants ranged from 19 to 41, though most (86%) were between 20 and 22 years old. Nearly all of the participants indicated they were either juniors (30.8%) or seniors (64.6%) in a four-year degree program; three participants chose not to identify their current standing.

Design and Analysis

One central challenge for this study was the difficulty of evaluating the impact of the social bookmarking activity on the knowledge and skills related to the course. Previous studies have determined that students who use social bookmarking in an academic environment have a

positive attitude about the activity and believe it to have a positive impact on their knowledge (Abbitt, 2007; Coutinho & Bottentuit, 2008). However, these studies relied on attitudinal surveys following the social bookmarking activities. It was an objective of this study to explore options for evaluating the effectiveness of a social bookmarking activity through more direct measures of student knowledge relating to the course content.

In designing this pilot study, it was necessary to consider which elements of the course were most closely related to the social bookmarking activity. As with many courses, this course for pre-services educators had several instructional objectives. Throughout the course, one primary objective was to assist students in learning about the various Internet resources available which relate to (1) locating and adapting lesson planning and curriculum resources and (2) identifying innovative and research-based strategies for effectively integrating technology into teaching. The social bookmarking activity was specifically designed to address these objectives and also to provide a way for students to share resources they had found with other students. This pilot study was developed as a means to better understand the social bookmarking activity and provide insight into future research and development of academic implementations of social bookmarking systems. To this end, the research design and data analysis focused on two primary research questions:

1. What are the patterns of user actions within the social bookmarking system?
Specifically, is there a discernable pattern in (a) overall weekly activity by users over the 10-week period, (b) depth of navigation within the site, or (c) use of sorting and filtering options?
2. How do users of the social bookmarking system compare to non-users in their ability to recall resources relating to course objectives (e.g., lesson planning and technology integration strategies)?

While students were expected to meet minimum requirements of the activity as a requirement of the course, the degree to which students either exceeded or failed to meet these minimum requirements would provide insight into overall user engagement. The investigation of user actions focused on usage data collected within the social bookmarking web application. Many aspects of user behavior were logged by the web application. The primary activities for users within the system were (a) viewing the list of sites, (b) sorting or filtering sites using built-in categories and filtering options, (c) clicking links to sites listed in the system, (d) posting new sites that would be available to other users, and (e) rating sites by casting either a positive or negative vote. All of these actions were recorded in a database table that would serve as the primary data source for identifying trends and patterns of user behavior. Because this was also a graded course assignment, users were required to post a minimum of one new item each week as well as read and vote on a minimum of two other items each week. Frequency and descriptive statistics were used to determine the most common types of user actions within the social bookmarking application.

Table 1

Usage Data Collected by Internal User Tracking System

Data	Description
User logins	Each login was recorded indicating a successful login with a date/time Stamp
Content item visits	Each click on a link to a content item was recorded in the database including the user ID, date/time stamp, and Site ID. In addition to providing data for usage analysis, this information was also used to prevent users from voting for sites they had not visited.
Votes	Users were able to cast either a positive or negative vote to indicate the approval or disapproval of a content item
Page Sorting Views	Each page view was recorded indicating the type of sorting, page number, and topic that was selected. This information could be used to identify how “deep” users were navigating for content items.
Topic list views	A record was kept of the number of times a user selected any of the available topics. This also provided information regarding how users were attempting to sort through the available content items.

The second focus of the research study on comparing users and non-users of the social bookmarking system proved to be challenging. Among the first challenges to be addressed was the difficulty in establishing a measurement by which users and non-users could be compared. Following the completion of the course, it was expected that the students would be familiar with Internet resources relating to (a) lesson planning and curricular materials and (b) sources describing research-based strategies relating to the integration of technology into education. These two objectives were selected as the primary focus of the survey administered at the beginning and end of the course. The difficulty remained, however, in measuring the degree to which students were familiar with Internet resources relating to these course objectives. Further complicating matters, there existed no common set of Internet resources to which all students would have been exposed. Because of the wide variety of majors in the course, students were encouraged to locate resources related to the content area they would be teaching. In order to address these challenges, the survey developed for the pilot study focused on measuring the number of sites a student could recall that were related to the overarching course objectives. While this would not necessarily form the basis for a robust comparison of users and non-users of the social bookmarking system, it would assist in determining if a difference might exist on a fundamental level and provide a starting point for exploration in future research.

The brief survey included open-ended items instructing participants to list up to ten websites for which they would find resources relating to each of the course objectives (lesson planning/curricular materials, technology integration). Following the administration of the post-test survey, each entry was then evaluated and coded as either a valid or invalid site reference according to the following criteria:

1. Valid site reference: References in which the information provided clearly identified a website which included information relating to the stated objective.
2. Invalid site reference: References to sites that could not be clearly identified or were not related to the stated objective.

Due to the difficulty of recalling exact website addresses, participants were allowed to enter either a Uniform Resource Locator (URL) address of a site or the name of a site. For responses indicating the name of a website rather than the URL, responses were coded as valid site references when a site matching the name could be located on the first page of Google search results found when entering the name provided by the participant. These sites were required to meet the criteria of relevance to the stated objective as well.

Following the coding of site references, a total number of valid site references were calculated for each participant and each of the two course objectives. As such, a valid site reference score was calculated for each respondent the indicated the number of valid site references provided relating to (a) lesson planning and curriculum resources and (b) technology integration strategies. Due to the differences in response rates from users and non-users of the social bookmarking system and the lack of randomized groups, comparisons between users and non-users were limited to descriptive statistics for this pilot study.

Results

Examining User Actions

The investigation of trends in user actions provided insight relevant to the design of the both the social bookmarking course assignment and the software system. Of particular interest were the activity rates over the 10-week period during which the students were required to participate in the activity. As shown in Table 2, the login frequency showed a general decrease after the first week. The overall mean over the 10-week period was 77.2 logins per week, 57.8 new items posted, 170.3 sites visited, and 101 votes per week for the 62 users of the system.

Table 2

User Activity Per Week

Week	# Logins	# Posted items	# Sites visited	# Votes
Week 1	125	53	209	79
Week 2	83	52	209	79
Week 3	76	73	147	94
Week 4	76	62	167	106
Week 5	75	81	150	123
Week 6	69	55	168	104
Week 7	58	41	109	61
Week 8	53	46	156	78
Week 9	68	58	125	101
Week 10	89	57	263	186
Mean	77.2	57.8	170.3	101.1

The weekly usage data also showed a slight downward trend over time, though there was a notable increase during the final week of the activity. The highest frequency of user login was during the first and last weeks, while the lowest frequency of user login was during week eight. The highest rate of new items posted was during week five and week three. The highest frequency of user voting occurred during week ten.

In examining the user activity by day of the week, the majority of activity in all categories (logins, new posts, votes, and visits to sites) was recorded on the day of the week that the class met (Thursday). These results are similar to previous findings of which the most active two days are the day of, and the day before, the regular class meeting time.

Table 3

User Activity by Day of Week

	# Logins	# New Posts	# Votes	# Visits to posted sites
Monday	82	44	70	199
Tuesday	81	48	106	203
Wednesday	193	109	195	486
Thursday	387*	322*	556*	679*
Friday	25	17	41	53
Saturday	28	13	28	26
Sunday	50	36	49	81

* indicates highest total within each category

A second indicator of overall usage of the system was the average activity per user. As required by the course assignment, users were expected to post one new item each week and vote on two items posted by other students. Over the 10-week period, the average user logged into the system 13 times, posted 10 new items, visited 30 sites from the system, and voted 18 times. As indicated by the low and high values for each user action, there were also users that were far below and far above the minimum requirements.

Table 4

Per User Activity 10-Week Summary

	# Logins	# Posted items	# Sites visited	# Votes	# Positive votes cast	# Negative votes cast
Mean	13.1	10.2	30.7	18.3	3.8	0.4
SD	6.0	4.3	20.4	6.7	5.9	0.9
Low	1	0	0	0	0	0
High	30	20	85	27	30	5

In order to understand user navigation within the system, three primary data sources were examined to assess how deep within the site users would navigate and which sorting and filtering were used most often. Based on the system logs, the average depth of navigation was slightly under three pages deep. Because the system displayed 15 items per page, the average user browsed through approximately 45 content items.

Table 5

Average Depth of Navigation into Content Item List

Mean	2.83
SD	5.61
Min	1
Max	59

The system also included several options for sorting the content items. The default view of the content items list was to show items posted in the past seven days sorted by popularity score (votes + clicks). Options were available for users to sort items by the number of votes (highest to lowest), most popular items (votes + user clicks), and by date (either newest or oldest first). While the default view was used most frequently (40%), users also used the “Most Votes” sorting option during 33% of the page views and the “Most Popular” option 12.4% of the time.

Table 6

Frequency of User Selected Item Sorting Options

User Selected Page View	#	%
Items posted this week (Default)	766	40.3
Sorted by most votes	626	32.9
Most popular (votes + clicks)	235	12.4
By date (most recent first)	154	8.1
By date (oldest first)	65	3.4

The system also included several filtering options by which the users could limit the list of content items to a specific category. Unlike the sorting options, there was no default option. Users were required make a topic selection before they were presented with a list of posted items. The list of filtering options was always available, and a user could switch to a filtered list at any time. The most frequently used option was the “All Sites” option (72.3%) with showed all of the items sorted by a popularity score (votes + clicks). The second and third most popular filtering options selected only items relating to Lesson Planning (9.8%) and Technology Integration (6.6%). The least frequently used filtering options were “Ed Tech News” (0.6%) and “Ed Tech Research” (1.5%).

Table 7

Frequency of User Filtering Selection Using Pre-Defined Categories

Topic name	#	%
All sites	1376	72.3
Tech integration	126	6.6
Lesson planning	187	9.8
Software tutorials	22	1.2
Teaching strategies	52	2.7
Curriculum resources	99	5.2
Ed tech news	12	0.6
Ed tech research	28	1.5

Comparison of Users and Non-Users

The comparison of users and non-users of the system focused on the ability of participants to recall and list resources relating to two specific course objectives. Using data from the scored survey administered at the beginning and end of the course, two scores were calculated for each participant which indicated the number of valid sites references provided that related to (a) lesson planning and curriculum resources, and (b) strategies and methods for technology integration. The mean frequency of valid site references for these two categories was then calculated for users and non-users. As indicated in Table 8 and Table 9, there was an increase in the number of valid site references for both users and non-users of the social bookmarking system. The rate of change between the beginning and end of the course for participants who were users of the social bookmarking system was higher in both categories of sites requested (lesson planning resources, strategies and methods of technology integration).

Table 8

Mean Frequency of Valid Site References for Users of Social Bookmarking System (N = 42)

Category	Before course	After course	Mean Change
Lesson planning	.88	3.38	2.50
Technology integration	.33	2.40	2.07

Table 9

Mean Frequency of Valid Site References for Non-Users (N = 23)

Category	Before course	After course	Mean Change
Lesson planning	1.61	2.57	.96
Technology integration	.43	1.17	.74

Discussion

In adapting any form of technology to educational purposes when it was not originally conceived as such, there undoubtedly should be expected a number of challenges. Among these challenges is the need for such technologies to be evaluated in terms of their educational value and possibly modified for this new purpose. The social bookmarking system and course activity used in this research study faced these challenges and must also be critically examined if any educational application of this idea is to be fully realized. It was the focus of this study to continue pattern examination of user actions within the system and also to explore the possible influence of this activity for meeting the educational objectives of the course in which it was implemented.

Limitation of This Study

A primary limitation of this study is the focus on one course and the implementation of one type of social bookmarking application. While these results may be informative to others seeking to integrate social bookmarking into other higher education courses, results may not be generalized to other types of courses or other social bookmarking systems.

Additionally, the measurement of the knowledge of users and non-users of the system piloted in this study was limited to only the ability of respondents to recall Internet resources relating to two course objectives. While this limitation may provide a general perspective of the possible impact of the social bookmarking activity on learning objectives, further development and refinement of the survey and sampling procedures will be necessary in order to determine any statistical significance for this difference.

There also exists the possibility that the different instructors for the two groups influenced the group comparisons. An effort was made to maintain similarity in both the content and assignments for the six sections of the course. Also, the social bookmarking system was presented as an activity to take place outside of normal class sessions. However, it is possible that the results were due to differing instructional approaches. Also, the low response to the survey from the non-users' group and the lack of random assignment to participant groups made inferential analyses inappropriate and limited the group comparisons to descriptive statistics only. As such, any differences between the groups may be the result of factors unrelated to the use of the social bookmarking activity.

Patterns of User Actions

The usage data collected by the social bookmarking system revealed that users were most likely to be active in the system on the day of the class session or on the day before class. These results are similar to a previous study with a similar social bookmarking activity (Abbitt, 2007) and suggest that the activity within the system is largely connected to the minimum requirements of the course assignment. This is further supported by the per user statistics that indicated that the average user participated at or near the minimum requirements of the assignment for posting and voting on new items. One interesting detail was found when looking at the frequency of visits to sites contributed by other users. Throughout the ten-week period, users visited many more sites than they voted for, and, in many weeks, the number of sites visited by users was more than double the number of votes. This finding suggests that users were browsing multiple sites while only casting a positive or negative vote for about half of the sites they visited. Based on this result, it is possible that voting is not the primary indicator of the amount of new content to which the users were exposed. It seems that while users were conscious of the minimum requirements of the course assignment, there was activity beyond those minimum requirements.

Also among the usage data was one finding that may need further investigation in order to be explained. The overall usage activity indicated that Thursday was the most active day of the week. As this was also the day of the class session, it was not surprising that many students would be participating in the social bookmarking activity either prior to, or soon after the class session. However, there was an unexpected increase in usage during week 10 of the activity. The social bookmarking activity was one in which students received a score each week that indicated the degree to which they met the weekly requirements. In this manner, students were not able to "make up" for low participation at the end of the activity. Also, students were not told exactly when the activity would end in order to reduce the likelihood of a spike in activity in an effort to make up for a lack of participation earlier in the semester. The end of the activity was announced in the class session during week ten, at which time the participation for that week was already completed. The social bookmarking activity ended approximately three weeks prior to the end of the semester. It is certainly possible that this increase in usage was still the result of an effort by

the students to increase their grade despite efforts to reduce and counteract this behavior. However, this change remains an anomaly in the overall trend over the ten-week period, and further investigation in future studies may reveal the underlying cause of this increase in usage at the end of the activity.

Group Comparisons

One aspect of the social bookmarking activity that was not examined in previous studies was the impact on knowledge of Internet resources relating to specific course objectives. It was expected that students in all sections of this course would become familiar with Internet resources relating to (a) lesson planning and (b) strategies and methods for the integration of technology into teaching. The social bookmarking system was implemented in the course to assist in meeting this course objective using a collaborative online system. Based on the results of the comparison of users and non-users, this study suggests that the social bookmarking activity may have a positive impact on the ability of students to recall the Internet resources relating to these course objectives. At this time, however, the extent and significance of this impact remains unclear due to the limitations of this exploratory study.

One notable finding is that both users and non-users were able to provide valid sites relating to lesson planning more frequently than they were able to provide valid sites with strategies and methods for technology integration information. In a related finding when examining user selection of filtering options, “Lesson Planning” was also the most frequently selected filtering option followed closely by the “Technology Integration” filtering option. While the selection of filtering options likely reflects a user preference for items in which they are most interested, these results do suggest that a connection may exist among usage activity, user preferences, and learning outcomes when integrating a social bookmarking system into an academic environment. It appears that the “Lesson Planning” category was more popular in the social bookmarking system than the “Technology Integration Ideas” category. This pattern was also present in the scores for both groups on the pre-test and post-test survey across these same categories and suggests that users are less able to recall resources for categories in which there is less activity by the participants.

The finding of a possible relationship between user preferences and learning objectives ultimately raises a question of how best to incorporate a predominantly user-centered activity such as social bookmarking into a course where desired learning outcomes may not match user preferences. It would seem that the patterns of usage in the social bookmarking system provide a glimpse of user preferences relating to content. These user preferences, however, may not necessarily align with course objectives. In this study, users exhibited both a preference for lesson planning resources over strategies for technology integration as well as a higher ability to recall these resources. This pattern is more reflective of user preferences than it is of the emphasis of the course for which strategies and methods of technology integration was a higher priority. While it is well beyond the scope of this study to adequately explore this issue, these results do illustrate a possible challenge to overcome when planning to implement a user-centered activity when user preferences may not align directly with course objectives.

Redesigning the Social Bookmarking System and Activity

In investigating the use and impact of any technology system being adapted for a new purpose, there is always a cyclical process in which a system is designed, tested, and revised in order to repeat this process with the goal of improving the system for its new purpose. The social bookmarking system, as well as the course assignment, described in this study must also follow this same process. Based on the usage data that indicate users browse most frequently in the first few pages of the content items list, a modification to the software system may be necessary to present content items in a more compact and efficient manner. In order to better meet multiple learning objectives, it may also be advantageous to allow the instructor some level of editorial control over which items are presented in the first few pages. One modification to the software system that might address these issues would be to allow a moderator (either the instructor or students) to move relevant items to a “featured content” section on the first page. This would allow various types of articles to be presented to all users regardless of their preferences. For example, items that are related to “Ed Tech Research” that would not otherwise be easily seen by students could be moved to a more prominent location that may increase the likelihood of students viewing and rating this less popular content. However, it is important that the user-centered nature of the system and activity be retained in order for students to remain the primary contributor and evaluators of information. Thus, a redesign of the user interface to allow users to easily view “featured content” as well as the list of other items sorted and filtered according to their preferences may help find a balance between user preferences and the need to meet various learning objectives. While these modifications will differentiate the system from the more common social bookmarking applications, it is this type of modification that will adapt the activity to some teaching and learning environments in which the activity is implemented for specific types of learning objectives.

Suggestions for Future Research

There is little doubt that much remains to be examined regarding the use of any technology system for teaching and learning. The results of this study suggest that there is value in using social bookmarking applications in academic environments. However, one important facet to consider is that of student engagement. It was noted in this study that overall activity within the system showed a slight downward trend over time. While the connection between overall activity and student engagement was not investigated, this should be considered in future studies. At this point in time, social bookmarking is a relatively new and novel idea. It is possible that this novelty will begin to wane, and students will no longer be engaged by activities such as this when they become more commonplace. Identifying which facets of the social bookmarking activity are most closely associated with student engagement will assist in the future evolution of this activity in teaching and learning environments.

Additionally, further study should continue to focus on adapting this type of activity to teaching and learning applications while retaining the user-centered design. It is the nature of social bookmarking systems and Web 2.0 technologies, in general, to focus on user control and user contribution, concepts that closely align with student-centered teaching practices. Future applications of this and other Web 2.0 technologies will benefit from maintaining the user-centered activities and connecting to specific learning objectives. This study focused on the

learning objective of awareness of Internet resources. Though this is a reasonable first step in evaluating the use of social bookmarking in an educational context, there are certainly higher-order learning objectives that can be impacted by this type of technology. Future studies may be able to investigate the use of social bookmarking rating and voting system on critical thinking about course related topics. By seeking to connect these types of collaborative activities to higher-order thinking skills, it will be possible to develop new and more efficient ways of implementing the rapidly changing forms of Internet technology to the unique teaching and learning situations.

Conclusions

Social bookmarking systems were originally designed for informal situations in which the goals of individual users may vary greatly. As an overall evaluation of the integration of a social bookmarking activity into an undergraduate course on the use of technology in education, the results of this study suggest that the social bookmarking activity may have an impact on the ability of users to recall Internet resources relating to specific course objectives. Because this was the primary objective of this particular assignment, this finding suggests that the activity may have increased the degree to which this learning objective was achieved. While this study has continued the discussion of possibilities for adapting one form of Web 2.0 technology to educational environments, there is undoubtedly more work to be done in this area and the challenge remains for research on the uses of various technologies in education to keep pace with the rapidly changing landscape of Internet technology.

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