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Revealing the Learning Effectiveness of Social Tagging in an On-line Reading Learning Environment

Jun Ming CHEN [a*], Meng Chang CHEN[b], Yeali S. SUN [a]
[a]*Department of Information Management, National Taiwan University, Taiwan*
[b]*Institute of Information Science, Academia Sinica, Taiwan*
*d96725001@ntu.edu.tw

Abstract: With the emergence of Web 2.0, social tagging provides an opportunity to help learners to share, organize, and manage the learning information from reading materials. Moreover, a tag-based learning system can enable them to complete their learning activities in an effective and efficient way through the use of web 2.0 social tagging technologies. However, few studies have directly discussed why social tagging can benefit from user-generated tags in reading learning. Therefore, this paper first explores the use of effective social tagging learning to help students not only improve their understanding of the English material that they read, but also develop their ability to read well. We then investigate how to apply tag-based learning to help learners focus on studying the resources and make sense of the material and remember it more easily. The experimental results showed that tag-based learning can improve users' efficiency in reading learning.

Keywords: Web 2.0, Learning effectiveness, Social tagging

1. Introduction

To make students proficient in the use of English language with reading learning, one efficient way is training students to think globally and capture the important concepts of the instructional material. Recent research has identified benefits to using Web 2.0 within the online learning. Moreover, web 2.0 tools and technologies can be used to develop adaptive learning environments, and stimulate different learning achievements. Thus, educators and administrators have thus been increasingly turning to Web 2.0 applications to enhance on-line learning and develop a new generation of learning architecture (Casey & Evans, 2011; Chen, Chen, & Sun, 2012; McLoughlin & Lee, 2010; Rodriguez, 2011).

Additionally, web 2.0 social tagging is also widely used in social platforms such as Flickr and Del.icio.us with their community-based user interfaces, which provide additional ways of innovative learning that enable users to organize and summarize new ideas and retrieve resources (Bateman et al., 2007; Heckner, Heilemann, & Wolff, 2009). Despite past studies demonstrating that social tags can improve users' efficiency in searching for resources (Golder & Huberman, 2006; Cho et al., 2012), studies are still lacking specifically regarding social tagging learning efficiency. The potential impact of Web 2.0 social tagging applications on English reading learning seems especially relevant and thus warranting further investigation.

In order better understand how social tagging impact learners' reading behaviors and enhance reading comprehension, this paper explores the learning effectiveness of social tagging by developing tag-based learning framework (TLF). The TLF framework for knowledge retrieval incorporates both social tagging and friendships inherent in the social network established among users, items and tags, which can act together to enhance the learner's ability. This is accomplished by collecting a representative portion of reading learning materials, capturing explicitly expressed bonds of friendship between users as well as by employing social tags. In this way, the study presents different beneficial aspects of tagging learning and its suitability for collaborative learning environments. These finding and results can thus provide instructors and administrators with suggestions and a reference for the future design of efficient web 2.0 supported collaborative learning activities.

Moreover, these indications warrant future experiments in social tagging applications in collaborative learning environments to further improve reading skills and recommendations.

2. Background and motivations

Social tagging originally emerged as a solution for enabling users to easily add metadata to online content, which would allow users to interact and easily share information (Chen, Chen, & Sun, 2010; Wang & Yang, 2012a). The tagging process also provides an easy and simple way to help learners to summarize new ideas, facilitate opinion exchange and communication between them and at the same time receive peer support through the viewing other learners' tags (Bateman et al., 2007; Bennett et al., 2012; Chen, Chen, & Sun, 2012a).

An extension application to tag clouds have emerged as an important new interface paradigm, quickly gaining popularity in social information sharing sites, which face the pressure to find visually appealing ways to summarize vast amounts of information (Guy et al., 2010). A tag cloud is mapped like a graph, where tags are represented as visually distributed nodes, and similarity relationships are the edges between the nodes (Shaw, 2005). Studies have indicated that tag clouds involve using semantic web technologies to generate semantic concepts, which offers a new way to extract meaningful learning results and analyze learning behavior (Chen, Chen, & Sun, 2012b). This information can be helpful to learners and teachers for enhancing search ability and evaluating student learning achievements. Figure 1 illustrates the example of social tagging and a tag cloud produced by students who were motivated by different focused concepts or topics. By crowd-sourcing intelligence in the form of tagged learner thinking, learners can be helped to speedily recover past observations and thoughts, with just a few tag searches.

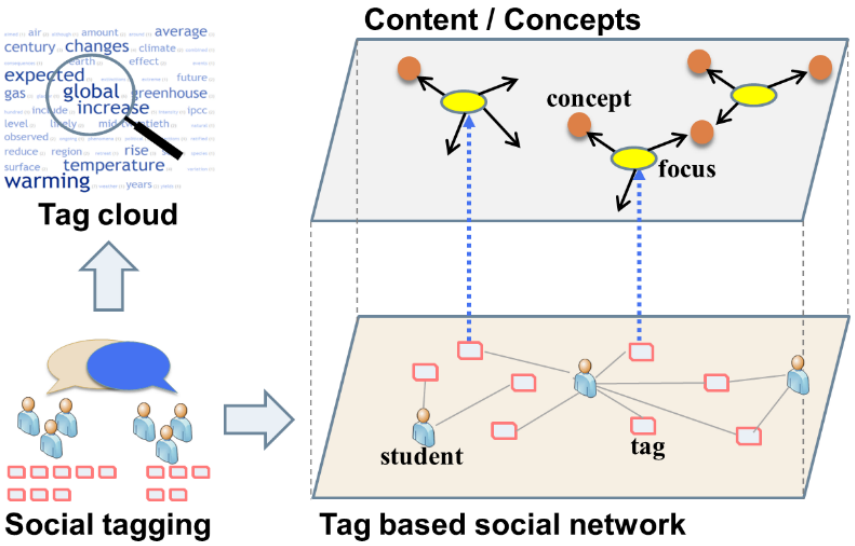

Figure 1. Social interaction & conceptual transmission with tags.

Although many social tagging systems have been developed and provide a rich support knowledge for users (AbuSeileek, 2011; Conole & Culver, 2010; Cress, Held, & Kimmerle, 2013; Fu et al., 2010), studies exploring and discussing social tagging and its potential for learning efficiency are few. Therefore, this paper focuses on investigating the effect of social tags on reading learning, and also performs an analysis of the learning behaviors of students for Web 2.0 social tagging learning to collect implicit information for learning related to English reading. Moreover, experiments were conducted to investigate how the use of tags facilitates collaborative learning (AbuSeileek, 2011; Erçetin, 2010).

3. Methodology

This paper develops a tag-based learning framework (TLF) and implements a tag-based reading learning system (Chen, Chen, & Sun, 2010; Chen, Chen, & Sun, 2011; Chen, Chen, & Sun, 2012a), which combines social tagging, collaborative learning, and the semantic concepts of articles to exploit quantitative and qualitative methods of data analysis to investigate the learning effectiveness of social tagging in an on-line reading learning environment.

3.1 A Tag-based Learning Framework (TLF)

A Tag-based Learning Framework (TLF) was implemented in this study in order to enhance the learning experience and performance by using a tag-based learning approach. Figure 2 depicts the TLF framework, which consists of three major layers. At the bottom layer of data storage, different application records were stored in the analytical database. At the analyzer level, a series of analyses provide descriptive and predictive results. For instance, a "structural analyzer" extracts the summary of article concepts from the reading materials; a "tagging behaviors analyzer" records the tagging learning portfolio of each student and then analyzes it to determine whether or not there are early indications of a learning problem by comparing it to the "semantic analyzer", which elicits implicit semantic relationships between tags and concepts. Finally, a "material recommendation analyzer" recommends appropriate supplementary knowledge to students and helps them gain new information from articles more easily.

At the application level, the student can explore valuable feedback from the integrated analysis of the above relevant components. For teaching guidance, a "comprehension assessment agent" provides correlate measures of thinking during tagging learning and more standard assessment measures (i.e. data preprocessing, structural analysis, semantic analysis, and tagging behaviors analysis); this information can assist teachers in understanding student reading behaviors. A "tag cloud representation agent" creates a visual representation of a piece of text/tag, based on degrees of relevance, and then discovers interesting clues and refines learners' thoughts or ideas of the reading through "social navigation agent". A "learning alarm agent" combines with the results "comprehension assessment agent" and "tagging behaviors agent" to support suitable supplementary materials by analyzing the characteristics of the tag. The last two agents in the TLF framework create a "test agent" that assigns appropriate test items to students and helps students to better understand the theme. Moreover, teachers may improve their methods of teaching by being more aware of what the students understand and what they do not understand. A "Feedback Agent" provides teachers with valuable input when they attempt to adjust their teaching strategies or diagnose a student's learning obstacles.

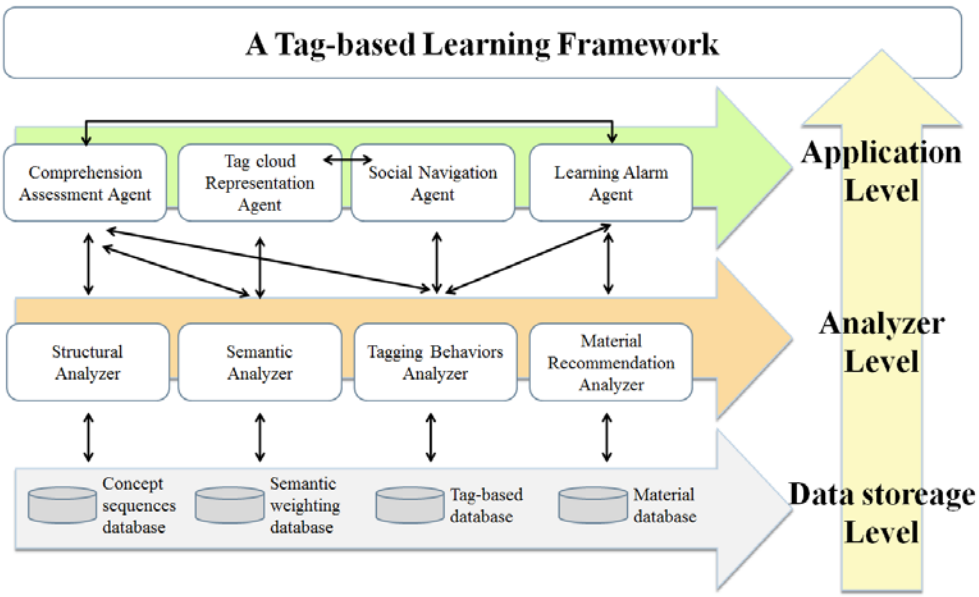

Figure 2. The tag-based learning framework.

3.2 A tag-based learning environment

A tag-based learning system was constructed for providing intelligent support through social tagging and semantic web technologies in order to enhance reading comprehension and learning performance for students. The system architecture is shown in Figure 3.

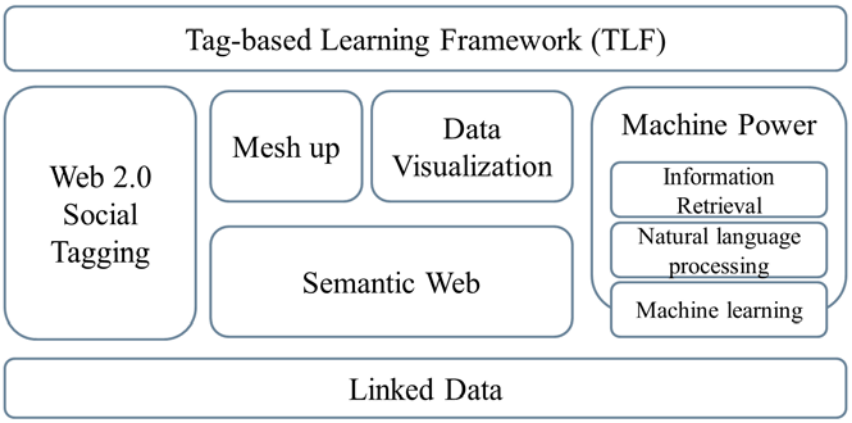

Figure 3. The system architecture.

The user interface of the proposed platform, shown in Figure 4, was divided into five parts. First, after logging into the learning environment, the students will see a list of subjects to be learned, which are pre-defined by the teacher. Once the students select a learning subject, a system interface for reading learning is displayed. In the next part, and according to the comprehension of the selected article, students can also utilize the input area to create a list of tags. The students use tags to make a clear overview in their mind for their reading. These tags can be regarded as a reading anchor for the students, including such aspects as the structure of the article, important points, and topics that might be most relevant to their reading goals. It is helpful if there is a list of words or phrases that sum up the main themes or ideas in the article. In the third part, students select this function that provides a quick and useful personal snapshot of an article's major themes, and includes the main topic of the article and necessary supplementary knowledge. This function of the system design had already been developed in our previous recommend system (Chen et al., 2011), and allows students to select any node to acquire new knowledge from the supplementary materials by using the learning recommendation mechanism. Fourthly, the tag cloud visualization tool was used to help students learn through discovering interesting reading clues and refining their thoughts or ideas of the reading. When students click on a given tag in the tag cloud, the tool not only serves as a useful reference guide, but also selects suitable supplementary materials for students by analyzing the characteristics of the tag cloud. In fact, the interface even provides students with the opportunity to mature socially by providing an avenue for student concept mapping, relationship building, and peer discussion. Fifthly, and finally, there is a post-quiz part that was used to measure students understanding and to help teachers evaluate students' comprehension of the article content. This information can be useful in helping the system to identify learners' misconceptions of the reading and assist them to promote their learning performance during learning processes.

4. Experiment Design

In our previous study, the pre-test and post-test experimental design was already described with the results indicating that the group using the tagging system demonstrated a comparatively significant improvement in reading comprehension ability (Chen, Chen, & Sun, 2012b). In this paper, in order to investigate more deeply the relations between social tagging and reading learning, and to discussed how to apply tag-based learning to help learners put more of their focus on studying the supplementary resources, an experiment was conducted to analyze the characteristics of students' tags and investigate the effectiveness of tag-based learning based on the TLF framework. The analysis methods used in this study apply content analysis, statistical analysis, and interviews with both students and teachers.

Specifically, 343 senior high school students participated in this study. The average age of the students was 17 years. At school, they had used computers for eight years and studied English for ten years. The tag-based learning activity encourages users to specify social tags and all the social tags of students were collected and stored. In total, we collected 7,720 tags with a total of 680 unique tags.

For material selection, the articles were selected from the fields of science, and the materials were ensured to be suitable for senior high school students. Throughout the experiment, students interacted by discussing, sharing, and learning in the learning activities, and they learned and gained new background knowledge to enhance their learning experiences and performances. To make sure that each student could understand and use the new system, a list of guidelines was generated with function descriptions of the system for students to follow. At the end of the experiment, students were asked to complete a survey about their tagging experiences. The questionnaire had a Cronbach's alpha of .805, which suggests high reliability.

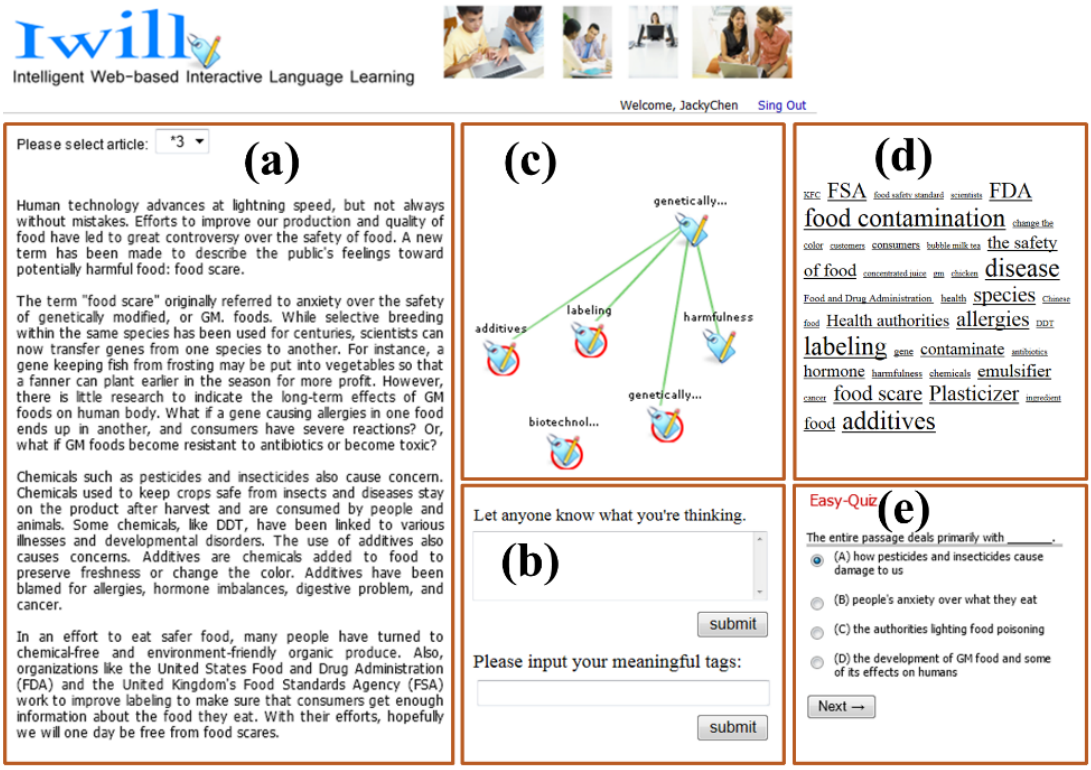

Figure 4. The user learning interface.

5. Experimental Results

In this experiment, we analyzed the tagging learning effect on tag structure, tag utility, and user satisfaction. The major findings are described below.

5.1 Analysis of tagging structure

By focusing on the tags which are most common in the tagging distribution, the top 30 tags were collected to undergo statistical analysis. The observation found that tag's distribution of tagging learning tended to stabilize into power law distributions, which means that the proportions of most common tags are nearly fixed over time, implying that students can use suggested popular tags from the tag cloud as a means of learning and accessing omitted information of the articles, or when a student cannot grasp the main points of the article. In other words, tagging learning provides another way to help students to more easily achieve an understanding consensus among learners (Golder & Huberman, 2006).

On the other hand, the experimental observations with tagging behaviors from the system log for students showed that 73% of the tags appeared in the content of the corresponding article. These

tags usually focused on the article title, or people, places, concepts and proper names found in the article. In order to more deeply understand tagging behaviors of user-generated tags and find interesting insights into reading learning, we classified features according to the classification of tag characteristics (Gupta et al., 2010), as shown on the left side of Figure 5. The interesting result shows that most of the tags used the content-based tags to identify the actual content of the article. In contrast, only about 14% of the context-based tags appear in the field of time and location, and approximately 26% of the tags belong to other categories (e.g., verb, adjective) or unclassified. These unclassified tags may point to the users' opinions and emotions, which are worthy of further investigation in the future.

Additionally, the issue of tagging knowledge sharing and reuse was investigated from different perspectives. The right side of the Figure 5 shows the dynamic effect of reused tags in that tag distribution could be more greatly concentrated on "action/event" and "title/concept". This finding indicates that these students gradually began to notice more nuanced details while developing the background knowledge they needed to understand the concepts in the readings. In other words, students chose to reuse tags through our proposed tag cloud, consisting of other students' tagging records, as a means to help them make sense of the complex contextual information of the article and accumulate knowledge. This information can be helpful to learners for enhancing their information search ability (Golder & Huberman, 2006; Cho et al., 2012).

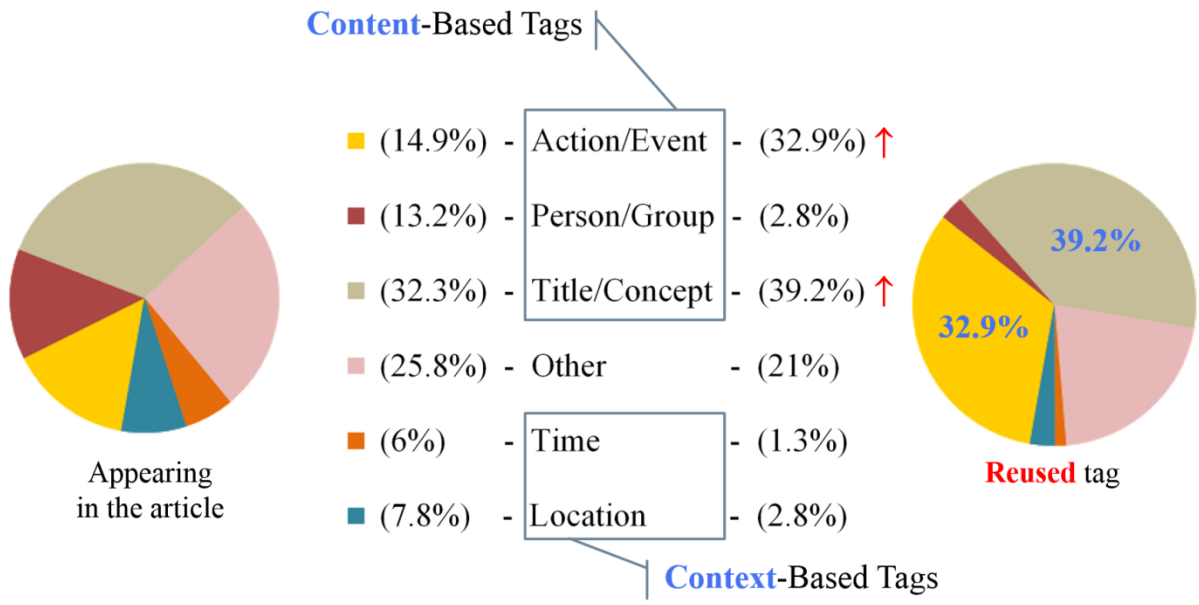

Figure 5. Distribution of user-generated tags (appearing in the article).

Furthermore, we also compared 27% of the social tags that did not appear in the corresponding article. The analysis results listed in Figure 6 reveal that these tags maintain a similar reused tag distribution and are almost exclusively concentrated on "action/event" and "title/concept", implying that tagging learning provides an opportunity to help students organize ideas and activate their thinking by the reuse of the tags.

Furthermore, we determined the origins of these tags to several related resources including the recommended supplementary knowledge/articles from a previously proposed recommendation system (Chen et al., 2011), online news, and an online dictionary of science. These links of information were analyzed to explore whether or not these tags could help students to gain different perspectives on the reading process. Within above mentioned two classifications of tag information (i.e., content/context-based tags), approximately 32% of the tags appear in recommended supplementary articles and 21% of tags appear in online news. This finding suggests that the tags provides a more natural and efficient way to help students acquire and link new reading clues and knowledge. These tagged resources can also be exceptionally useful in providing student learning references and access to helpful information.

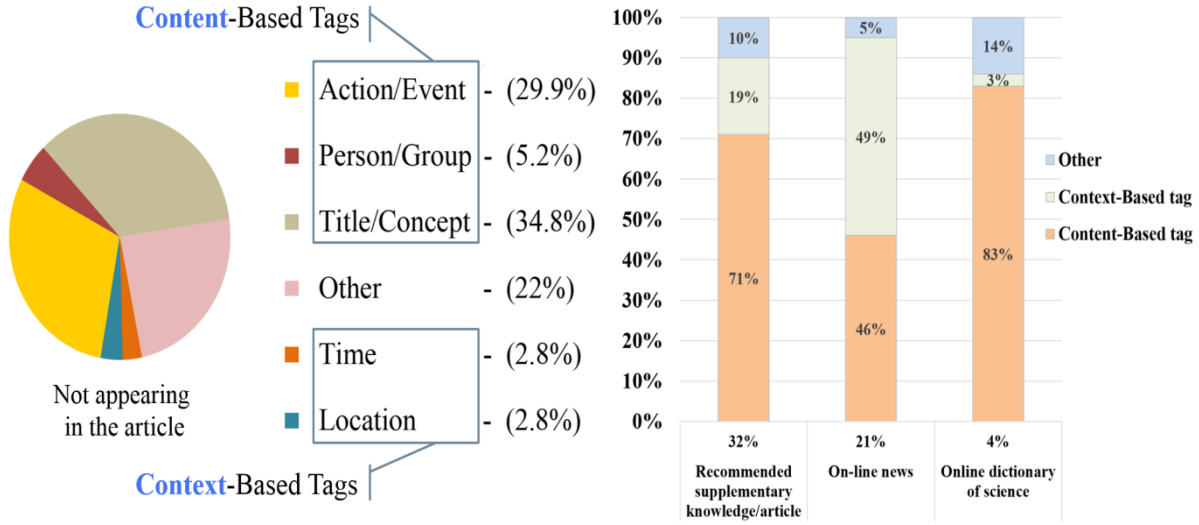

Figure 6. Distribution of user-generated tags (not appearing in the article).

5.2 Analysis of learners' tagging motivations

In this case study, 193 participants took part in this experiment. Each student was asked to complete a survey measuring motivation with a five-point Likert Scale (Gupta et al., 2010). The major type of motivation for learning is shown in Figure 7. The results of the analysis show that 37% of the students had a tagging motivation that aimed to help them organize the context of the article. Secondly, 22% of the students thought that tagging can both enable the discovery of relevant resources and assist them in discovering implicit concepts about which they read. The major tagging motivations related to the expression of their opinion and the sharing of their exchange experience was 15% and 11%, respectively. Finally, few students expressed a tagging motivation aimed at attracting other students' attention (7%), enjoying competitive learning (2%), and self-expression (6%). By observing the tag diversity from the various tagging motivations, the students realized that shared social tags could enable learning communities to obtain richer meanings which they could not achieve on their own.

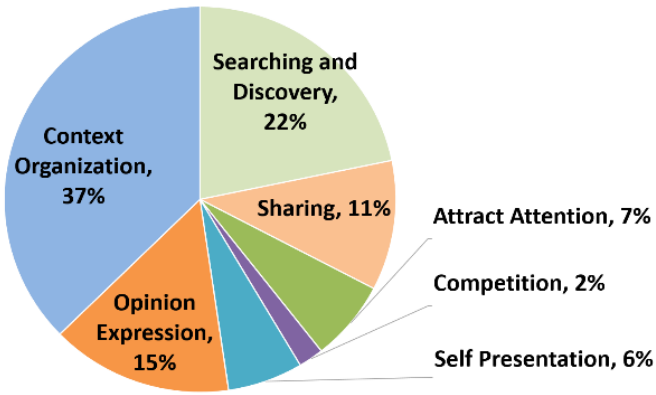

Figure 7. Motivations behind Tagging Learning.

5.3 Analysis of satisfaction levels with tagging learning

In order to understand if the tagging learning would be helpful in enhancing students' learning experience, a questionnaire was used to collect feedback concerning the perceived usefulness and ease of use from students in the experimental group. The Cronbach's alpha value of the questionnaire items was 0.734, with a score higher than 0.7, suggesting good questionnaire reliability (Nunnaly, 1978). Table 1 depicts a portion of the questions and the corresponding results, which show that most of the students had positive attitudes about using the tagging in learning activities. Most of the students also thought that the tags were easy to use in the social tagging learning system. Despite the

results suggesting a positive effect for learning, we nonetheless observed a few students who still did not effectively use tags due to their inability to use the tagging links to improve their learning. This finding reveals the need to offer tag training so that more students would be able to use the tags within the tag-based learning system.

Table 1: A part of survey results.

Question	*Mean
I think the tagging was easy to use	4.5
I can get started quickly with the tagging learning without guidance	3.8
I think the user-generated tags were useful during the tagging learning process	4.7
Tagging learning can inspire me to rethink other ideas which have never been noticed by others	4.1
By tagging learning, I think the tagging learning can enable more efficient reading	4.3

* 5 is complete agreement and 1 is complete disagreement

In addition to students' satisfaction with the tagging learning, two experienced teachers observed the students' learning behavior. The investigation of the teachers' feedback regarding their monitoring of the students' use of tagging learning to promote the learning success of every student resulted in the conclusion that the students shared more ideas and had better discussions when they practiced with the tagging learning guidance. As mentioned in the above analysis results, the teachers agreed that tagging learning and recommending can reinforce background knowledge and influence the students' concentration and responsiveness. Moreover, students were found to learn and remember new information best when the social tagging learning system provided links to relevant background knowledge. Most of the teachers also wanted to continue using the system and were willing to recommend it to other teachers.

6. Conclusion and future work

This paper explored the impact of using the Web 2.0 technology of social tagging learning to enhance the effectiveness of reading learning. A Tag-based Learning Framework (TLF) was developed that can provide a richer understanding about why users tag, and how users can more efficiently employ tags and tag preferences to enhance the learning experience and knowledge transfer. We also surveyed the learners' perceptions on social tagging, which was on the whole positive. The experimental results also helped us to reveal that social tagging learning offers students a novel learning approach to more effectively learn when reading. These results also point to suggestions and references for the design of efficient web 2.0 supported collaborative learning activities in the future. Further research will be needed to investigate this methodological concern and its practical application.

Acknowledgements

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