Engagement in Online Collaborative Learning: A Case Study Using a Web 2.0 Tool

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Abstract

In this study, the author employed a Web 2.0 tool to promote student online collaborative learning. Fifty-five college students majoring in information technology and management participated in the two-week study, conducted in a programming language course. Qualitative research methodology was utilized to collect data. The results show that the technological tool motivated students to engage in collaborative learning, and its use supports student learning.

Keywords: Wiki teaching and learning, online social interaction, programming language learning, technology integration in classroom, scaffolding tool

Introduction

Today, constructivism reverses the learning trend that behaviorism dominated for many years (Bransford, Brown & Cocking, 2000). Instruction has shifted from a teacher-centered to a student-centered environment. Students are no longer passive information-receivers; rather, they are active knowledge-constructors (Schunk, 2004). During the knowledge-construction process, tools should be provided to support student learning (Davis & Miyake, 2004). Technologies often serve as scaffolding tools in the learning environments (Jonassen et al., 2008).   For example, Bell and Linn (2000) employed a technological program called KIE to support students' reflective thinking and argumentation skills.

To date, web technologies have moved toward a Web 2.0 standard whose core value is social networking. In the Web 2.0 online environment, social networking is a concept which emphasizes collaborative user-to-user interaction (Vickery, 2007). The goal of social networking is to provide a community-based website where users can share personal experiences and construct their knowledge (The Horizon Report, 2007). According to Leuf & Cunningham(2001), a wiki is defined as a "…collection of interlinked Web pages, a hypertext system for storing and modifying information— a database, where each page is easily edited by any user with a forms-capable web browser client" (p. 14). In this platform, users can easily engage in collaborative learning (The Horizon Report, 2007). For teaching and learning purposes, wiki use is a prime example in which social networking functions as an intellectual technology tool to promote collaborative learning (Raman et al., 2005).

Recently, a number of studies have reported that the wiki technique supports teaching effectiveness and' learning outcomes. For instance, Vaughan (2008) indicated that wiki use in the classrooms can promote peer collaboration and support learning. Similarly, Wang (2008) reported that a wiki is a useful digital tool for teaching. In Taiwan, however, because of cultural factors, wiki use in the classrooms is not as popular as in the United States. Until now, the number of empirical studies regarding wiki integration into

instruction in Taiwan remains sparse. For this reason, this study explored the effect of wiki use on Taiwanese college students' collaborative learning.

Related Literature Survey

Wiki in the classroom is an innovative approach. The popularity of wiki technology for teaching and learning contributes to collaborative learning (Engstrom & Jewett, 2005). In the wiki platform, students can join together for editing the same project's page contents in real-time (Jonassen et al., 2008). To understand fully the related studies regarding wiki use for student learning, Table 1 summarizes the findings of several researchers as reported in current literature.

The findings listed indicate that integrating a wiki into the curriculum tends to focus on non-engineering education classes, and the amount of existing literature regarding use of wikis is limited. Whether wikis can support engineering student learning remains undetermined. Therefore, the purpose of this study was not only to examine the effect of wikis in engineering learning, but also to add practical insight into the existing literature.

Table 1. Related Studies

Selected Study	Subject	Context of study
Engstrom & Jewett (2005)	K-12 student	To allow students to explore geographical issues
Bold (2006)	Graduate student	To support student learning in an online course
Hewitt & Peters (2006)	Online student	To promote knowledge sharing in an online course (In the filed of education)
Armetta (2007)	College student	To help students learn composition and rhetoric
Rueckert et al. (2007)	ESL student	To help students learn English
Castaneda Vise (2007)	College student	To help students learn Spanish
Plowman (2007)	College student	To allow students to discuss social justice issues
O'Bannon (2008)	Pre-service teacher	To develop collections of curriculum specific web sites
Ioannou & Artino (2008)	College student	To promote knowledge sharing in an education technology class
Vaughan (2008)	College student	To allow students to summarize online discussion forums
Solvie (2008)	Pre-service teacher	To support student learning in reading methods courses
Wang (2008)	Instructor	To support faculty development

Case Scenario

Study Context

Participants for this study were 55 college students majoring in information technology and management at a university in southern Taiwan. Their computer skills were expected to be better than average considering their major course of study. A two-week wiki activity, implemented in a programming language course, Advanced Dynamic Programming, occurred during the spring 2008 semester. Two weeks prior to the study, all participants received notification of the upcoming activity.

Before the study, both the researcher and the course instructor engaged in three preparatory activities. First, the tool shown in Figure 1, PBWiki, created a course wiki with several web pages modified to coincide with the learning goal of the activity. Second, a detailed activity description and a wiki instruction package were formulated to guide students toward successful learning. Lastly, through the PBWiki mail system, 55 individualized e-mails invited participation and provided the method that allowed students who received the e-mail to access the course's wiki page without a complicated registration process.
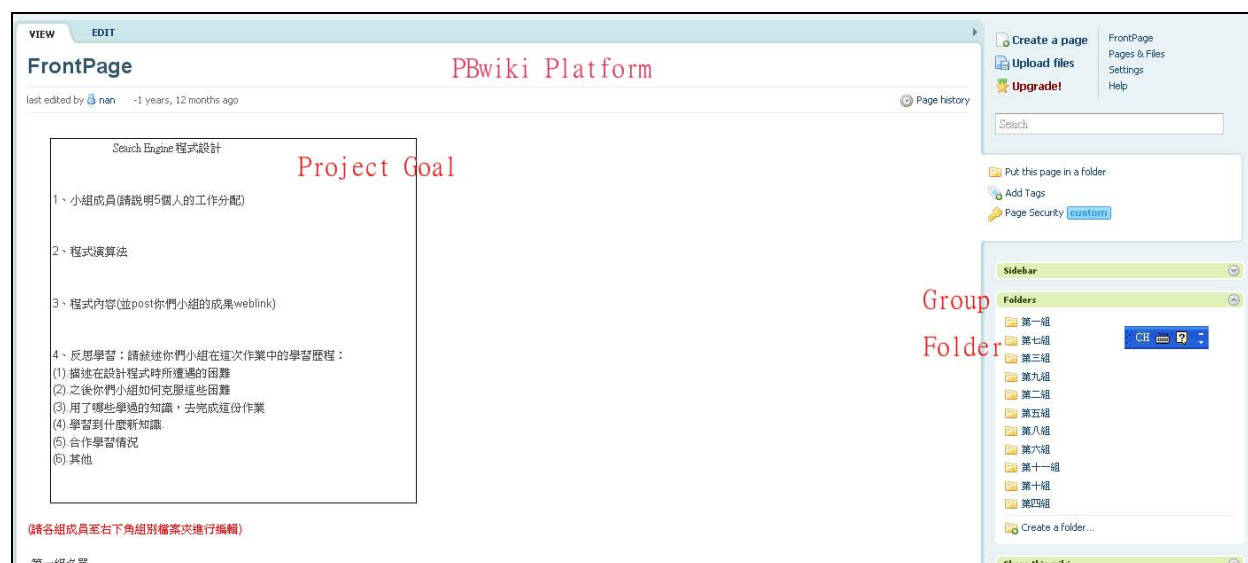

Figure 1. Screen shot of the PBwiki Platform

Research Design

The five characteristics of meaningful learning with technology proposed by Jonassen et al. (2008) served as the details of the wiki activity.

1. *International (goal directed/regulatory).* Participants, randomly divided into 11 groups, were to complete a small group project within a two-week timeframe. The goal of the project was to develop a dynamic program, a search engine system, by using PHP programming code and MySQL database. The programming skills needed for the project were those developed during the previous 8 weeks of class. The assessment standard for the project consisted of two parts: the final product and the wiki page. Based on functionality, creativity, and aesthetics of the final product, the instructor assessed 70% of the project's score. The other 30% accrued from online performance in the wiki page.

2. *Active (manipulative/observant).* Each group possessed a collective folder in the wiki page. In this folder, group members easily created a new page or edited material initiated by other members. In other words, students manipulated all learning objects from the course wiki website and observed the results of their manipulations.

3. *Constructive (articulative/reflective).* By posting a new page in the group folders, each group constructed their knowledge, including an explanation of various members' roles in the project, illustrations of programming structure, demonstrations of project results, and individual reflective learning. During the knowledge construction, the instructor accessed each group's folder to provide feedback every day.

4. *Authentic (Complex/Contextual).* The career goal for all participants was to achieve status as a successful computer engineer or a technology specialist. In real-world workplaces, they will encounter situations in which teamwork is a crucial component during product development. The expectation for this project was that students immersed themselves in the real-world task and better understood what they learned as a result of the project-based nature of the assignment.

5. *Cooperative (collaborative/conversational).* Each team member in a given group worked collaboratively toward the final product. In addition, each group browsed the other groups' folders, and peer evaluations promoted project improvements.

Research Method

This study adopted an action research approach. According to Gall et al. (2007), the purpose of action research is to "increase the quality, impact, and justice of education professionals' practice" (p. 597). This study expected that wiki in the classroom would not only provide the instructor with an opportunity to examine current instructional strategies, but also allow the instructor to re-create a modified learning activity based on the result of this study.

In order to understand better the effect of wiki in the students' learning outcomes, qualitative research methodology became a primary technique for data collection. For each group's wiki pages, the researcher used a content analysis approach to explore students' online behavior as demonstrated in each group's folder. As for individual learners, survey questions elicited students' perceptions of using wiki in the classroom. In addition, comparison of the results from the two sources (i.e. qualitative and quantitative data) yielded reliable evidence of the particulars of wiki use. Figure 2 summarizes the research process in this study.
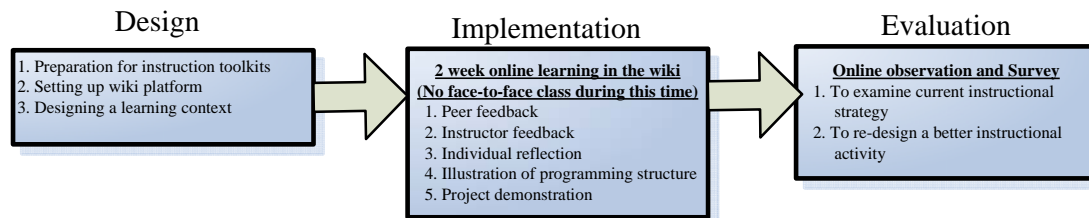
Design　　　　　　　Implementation　　　　　　　Evaluation

| 1. Preparation for instruction toolkits
2. Setting up wiki platform
3. Designing a learning context | **2 week online learning in the wiki**
(No face-to-face class during this time)
1. Peer feedback
2. Instructor feedback
3. Individual reflection
4. Illustration of programming structure
5. Project demonstration | **Online observation and Survey**
1. To examine current instructional strategy
2. To re-design a better instructional activity |

Figure 2. Research process in this study

Results

At the conclusion of the study, all groups produced well-functioning dynamic programs. An analysis of each group's content and survey results produced the following conclusions:

Content Analysis by Online Observation

During project development, online observations followed the development of each group's folder in the wiki platform. During the first week, each team seemed to focus on preparation of the project. Team folders reflected no new contents. After the first week, each team initiated uploading the required information to the wiki page. At the same time, based on wiki contents, the instructor provided each team with immediate feedback to guide students toward the right track. Four phenomena arose during the second week:

1. *Waiting for uploading.* Each team should have provided an illustration of the programming structure, but no team seemed to want to publish the results until other teams had done so. Once one team created a wiki page, other teams followed the first team's lead.
2. *Competing with each other.* Although the project goal for each team was the same, the features of the search engines submitted by the teams were totally different. For example, one team chose *lyrics* as the main topic. They created a lyric search engine in which users can use a song title as keywords to find the desired lyrics. A screenshot of this engine is shown in Fig. 3. Before the due date of the project, however, each team constantly added new features in their search engines. A competitive spirit seemed to arise among the groups. No team wished to be situated in a disadvantageous position. As one team updated its search engine, the other teams added similar features to their pages as well.
3. *Poor reflective learning.* Each team focused on the design and development of the search engine, which resulted in shallowness of content of the reflective learning submitted to the wiki pages. Students tended to describe something trivial during project development. Few of them linked what they had learned before the current project, which fell short of the instructor's expectations. For this reason, the instructor constantly provided feedback on the students' online reflections.
4. *Few critical comments.* Students often complimented other students' efforts, but critical comments were very uncommon in the wiki page. To achieve better collaborative learning, the instructor constantly intervened in peer feedback sessions among the teams. After students received the feedback guideline, critical feedback increased.

Figure 3. One of group projects: A lyric search engine

Survey Questions

After the two-week wiki activity, a self-perception questionnaire elicited participant opinions about the wiki project. The questionnaire consisted of two parts: four Likert-scale questions and one open-ended question. The results of the former appear in Table 2.

The results shown in Table 2 indicate that students agreed that the wiki activity supported their learning during the project's development (Q1, Q3, and Q4). Moreover, from a learning perspective, students were motivated by the innovative technological tool (Q2). However, although student attitudes toward wiki technology were positive, examining the learning experience from non-scale measurements was necessary. Therefore, one open-ended question elicited student opinions regarding the advantages and challenges of wiki use. Table 3 summarizes the analytical results of the open-ended question.

Table 2. Survey Results of Four Likert-Scale Questions

Question Statement	Mean
1. The wiki activity facilitates our group work.	4.00
2. The wiki activity motivates me to learn something.	3.75
3. Online reflection improves my learning outcomes.	3.65
4. Feedback from peers and the instructor is beneficial to my learning.	3.60

Table 3. Summary of the Analytical Results of the Open-ended Question

Advantages		
Theme	Example of student comments	Number of related comments
1. Motivation/ Interesting	*For me, this is the first time using wiki page. It is fun! Compared to traditional teaching, it really motivates me to learn course materials.*	7
2. Learning from others	*From other groups' wiki folders, I can learn something I miss in the class*	9
3. Better place to communicate with other people	*Very easy for me to communicate with my group members.*	15
4. Easy for editing the contents of project together	*It is very convenient to edit the contents with my team members in the same platform.*	12
5. Feedback	*Peer and instructor feedback improves our work.*	4
Challenges		
Theme	Example of student comments	Number of related comments
1. Limited time	*Two-week period is so short. We need more time for our project.*	6
2. Learning burden	*Compared to traditional team projects, we spend much time on this project.*	7
3. Dislike of the random assignment of team members	*I prefer to work with classmates with whom I am familiar. Most of the time, it is difficult for me to schedule the meeting time with my team members.*	13
4. Stressful tasks	*Based on instructor feedback, we should constantly change our project. Also, we need to respond to other classmates' comments all the time.*	6

In terms of the advantage of using a wiki, two themes support the results of the Likert-scale questions: motivation/interesting and feedback. The other three themes can be attributed to the technological features of the wiki platform (Themes 2, 3, and 4 in the Advantages theme). In contrast, for the challenges students faced, because the wiki activity was a new teaching strategy in this class, the expression of negative comments regarding extra learning tasks is not surprising. However, almost one third of the students disliked the method for assigning team members. They preferred to work with their "good partners" (i.e. classmates with whom they are familiar).

Discussion

The reason this study implemented random assignment of team members is that the course instructor had concerns about socially motivated loafing in the class (see Piezon & Donaldson, 2005). The instructor's prior teaching experience had shown that students often choose group members for very specific reasons. For example, students with weak programming skills are more likely to choose those who can cover their programming weakness. The rationale for random assignment was to eliminate the dependency mentality among team members. However, the results of the study show that almost one-fifth of students disliked the random assignment method. Working with someone unfamiliar was uncomfortable. Due to the limitations of the data collection technique, a follow-up study, such as individual interviews with students, would verify the influence of the random assignment's decreasing the effect of social loafing.

The results of this study are consistent with Vaughan's (2008) findings. The technological features of wikis, such as a better communication channels, can facilitate group work. Moreover, this study confirmed that wiki technology can support student learning (Armetta, 2007; Bold, 2006; Castaneda Vise, 2007; Engstrom & Jewett, 2005; Hewitt & Peters,2006; Ioannou & Artino, 2008; O'Bannon, 2008; Plowman, 2007; Rueckert et al., 2007; Solvie, 2008; Vaughan, 2008).

However, a polarized reaction appeared in this study. While some students perceived that the wiki tool motivated and benefited their learning, others felt that the extra effort generated by the nature of this project caused an additional learning load. Speculatively, those who expressed negative comments are resistant to a change in their personal learning models. According to Roger's (2003) diffusion theory, these reluctant participants became adopters of an innovation, later. In other words, adjustment to a new teaching strategy required extra time for acclimation.

In this study, although instruction for peer feedback and online reflection (see appendix) was provided to students, their initial online performance was poor. With regard to peer feedback, the instructor adopted the role of facilitator to steer students in the correct direction. To obtain meaningful peer comments, constant guidance from the instructor was necessary in the student-centered learning environment (Jonassen & Land, 2000). Considering self-reflection, the quality of student responses tended to be superficial learning. Even though immediate feedback was provided by the instructor, the contents of self-reflection did not seem to improve significantly. In an effort to decrease the number of shallow descriptions, students should have been taught how to create high quality reflective content before engaging in reflective learning (Devlin-Scherer et al., 2006).

In this study each team apparently participated in a competitive game. Once one team updated the features of its project, other teams would follow this path. No one wanted to occupy a disadvantageous position in a public context. Perhaps the competition not only allowed students to understand what they would face in the professional information and technology fields, but to also adopt the role of observer to learn from peers in order to polish the project's final results (Vaughan, 2008).

Conclusion

This study implemented a two-week wiki activity in a programming language class. The findings of the study showed that this new teaching method could motivate students to engage in collaborative learning and could support learning outcomes. Moreover, students felt that the features of the wiki platform facilitated their group work. Although some students expressed concerns for the burden of learning and stress from tasks, the learning effectiveness resulting from the wiki activity can surmount those uncomfortable feelings.

The wiki platform created in this project just provides a learning context in which students can improve their professional knowledge by means of collaborative learning. In the future, based on student negative comments, the current instructional strategy will be modified and a new learning activity will be proposed, which can better facilitate teamwork and support student learning.

Acknowledgement

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