

AC 2010-1581: USE OF WIKIS IN CONSTRUCTION EDUCATION

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Use of Wikis in Construction Education

Abstract

This paper focuses on the use of wikis for collaborative learning and knowledge creation in construction education. The purpose of this paper is to present the use of wikis in a Construction Management (CM) course as a case study. Knowledge Management System (KMS) for the construction and engineering industries is a new and exciting area of study, and wikis are a form of electronic KMS. In the last few years there have been studies done on the use of KMS as it relates to a construction or engineering company's internal tacit knowledge capture, collaboration, and retention. But little has been researched in the use of these technologies in the education sector. If the construction industry is using these types of technologies as a part of normal operations, then construction academic programs should also integrate them into the curriculum. This paper reports findings from in-class observations, surveys, and follow-up interviews that investigate the use of a wiki in a construction course. By using descriptive statistical analysis along with the results from the follow-up interviews, the study intends to provide valuable suggestions for instructors who are interested in using wikis in their classes. The survey results show that students find their experiences wikis positive and not only do they prefer to continue using wikis in the future, they also would recommend the use of wikis in other courses.

Background

The study was conducted in the Construction Management (CM) Program at Milwaukee School of Engineering (MSOE). The Construction Management program at MSOE which is accredited by American Council of Construction education is designed to make the graduates highly competitive by concentrating on knowledge and skills required in the construction industry. The program is housed in Architectural Engineering and Building Construction department. The number of undergraduate students in the CM program is approximately 150. The department has 18 full-time faculty members, 4 of which are designated as full-time Construction Management Faculty.

One of the strengths of the Construction Management program at MSOE is industry support in the form of the Construction Management Industry Advisory Council (CMIAC) which consists of industry experts and practitioners who support CM education by providing advice and oversight from the construction industry. The CMIAC offers direction on curriculum content, employment, scholarships and internships to ensure the program maintains a level of excellence that meets the needs of the industry.

Problems

One of the recurring comments from CMIAC members was the lack of communication and interaction skills from recent graduates who enjoy audio-visual learning environments rather than a read-write culture. CMIAC specifically asserted that the graduates should be able to write professional business letters and other project-related documents in high quality. The CMIAC

members also agree that the industry is moving toward integrated design and construction environments that require a higher level of collaboration with project team members.

As an attempt to remedy these needs, wiki-based group assignments were implemented in lieu of traditional writing assignments. Wiki is a website that allows the easy creation and editing of web pages via a web-based editor. A good example is wikipedia.com. A group of registered users can freely contribute to the contents of wikipedia.com that is open to the public. Wikis are often used to create collaborative websites, to organize research community websites, and to develop educational web sites as a KMS. Key advantages of using wiki are collaborative knowledge creation, self-regulated learning, and fast knowledge dissemination. The premise for developing the wiki-based group assignments was to explore new ways to help students improve communication and team interaction skills⁷.

Methods

The aim of this descriptive study is to investigate student perception and the use of a wiki for collaborative group assignments in a construction management class to support collaborative learning and knowledge creation. This research also aims to evaluate whether the use of a wiki encouraged ongoing interaction throughout the duration of the entire quarter.

A case study was implemented in a one of the CM courses: CM 4311: Construction Project Management 1 at MSOE in the fall quarter of 2009. Major course topics include project meetings and negotiations, project reports and records; preconstruction operations, construction operations, electronic project administration, construction delivery methods and project management planning.

The participants of the study were 4th-year students majoring in CM who were enrolled in an undergraduate course “CM 4311-Construction Project Management” as part of the Bachelor of Science in CM program. Seventeen senior undergraduate students enrolled in the course participated in the study. Wikispaces.com was chosen as the wiki website for the instrument. Three of seventeen students previously used a different wiki web site (Figure 1). Twelve of seventeen students had several years of prior industrial experience as project engineers or as project interns. All of them have been using collaboration software such as messengers, Twitter™, Facebook™ or MySpace™.

<i>Major</i>	<i>Prior wiki experience</i>		
	<i>Yes</i>	<i>No</i>	<i>Total</i>
Construction Management (4-year B.Sc. Degree)	2	8	10
Architectural Engineering/Construction Management (5-year B.Sc. degree)	1	6	7
Total	3	14	17

Table 1 Summary of Participants

A survey was developed of 12 questions, which elicited students' comments on wikis. Both qualitative open-ended questions and quantitative questions were included. A 10-point Likert scale is also used to measure students' perception on the effectiveness of wikis. Questions were asked on two aspects: personal experience on wikis and pros and cons of using wikis for group assignments. When looking at the students' experiences, the following questions were asked:

Have you ever used wikis before? Do you like wikis for developing a research paper with team members? Did wikis help your group improve productivity on developing the project? Do you want to recommend the use of wikis in other classes? What is your favorite function of wikis? Do you have any suggestions on wiki to make it better? On a scale of 1 (least) to 10 (most), how effective do you think wikis is?

Literature review

Knowledge Management (KM) refers to “the process by which knowledge is created, acquired, communicated, shared, applied and effectively utilized and managed, in order to meet existing and emerging needs, to identify and exploit existing and acquired knowledge assets³.” The primary objective of this system is to create a shared intelligence database that can be used by all members of the contributing organization for use in increasing the overall knowledge base and productivity of the organization. The use of a wiki is one such tool implemented by KM systems.

“Wikis” are websites that allow visitors to easily add, remove, edit, and change available online content, in a collaborative manner typically without the need for registration and webmaster involvement⁵. Users are allowed to post their information on these wikis with little training or computer experience, making it easier for the free flow of information. But with this free flow of unregulated information the possibility of proliferation of misinformation is also possible.

The use of wikis in an academic setting, specifically in the construction education arena, is fairly new. The use of the KM tools such as wikis for use in the classroom is becoming more evident. A recent study identified seven possible uses of wikis in education, with items ranging from using the wiki to publish the course syllabus to students using the wiki to develop research projects¹.

Another research paper has focused on the increased popularity of wikis as teaching tools in recent years, and showing why the wiki is a better educational tool than a blog⁶. Many educators use wikis because of their convenience and ease of use. Educators also need to teach what wikis and other social software mean to business, not just as a phenomenon, but also as a skill⁴. By incorporating wikis into the classroom, educators can better prepare students to make innovative uses of collaborative software tools⁶.

Although these articles show the possible uses and benefits of wikis in higher education, there are also drawbacks. Many studies point to a link between the success of wikis in education and incentives or even pressure provided by the instructor². Ebner et al.² conducted an experimental study to investigate the use of collaboratively created knowledge to reduce individual efforts for

preparing for a written exam, without the use of wikis being enforced or rewarded. The results of that study showed that none of the 287 students used the wiki the entire semester².

The literature review points to the possible uses of wikis in higher education for construction education. There are many potential benefits to the students and to the instructors for using wikis, but it has also been shown that potential problems may occur when using these systems. Because of this, future studies of the use and effectiveness of wikis in the classroom needs to be conducted and more data collected. This study looks to add to this knowledge base.

Collaborative writing assignment

Two collaborative group writing assignments are introduced in this section. Each team had 4-5 students. The first assignment was to write a research paper to report innovative business strategies that could be implemented at times when things are not going well (Figure 1). The students conducted a literature review, on-site interviews and collected data from local construction companies. The teams were strongly encouraged to use a wiki to share knowledge and information, which include articles, videos, pictures and other interview data. Students were required to begin with a working definition of innovation strategies as discussed in the class. They conducted a literature review and were to find at least 3 articles, either on the internet or in magazines, talking about innovation strategies in tough times. The students were then required to find a real case study that shows implementation of the chosen strategies in a construction company. Each team was required to bring at least two real examples from previous work, interviews or site visitations. The paper is designed to provide a clear statement of the direct and indirect benefits of the selected strategies, processes and cultural issues relevant to them. The instructor purposely gave a short notice on this assignment in order to test how the wiki improved productivity on the research project. The instructor observed how the team members work together by checking page editing history.

The second assignment was to develop a construction project manual as a group. Construction project manuals typically contain instructions for all aspects of construction jobsite operation such as communication, safety, quality controls, and project closeout. The students collaboratively work together to collect information and complete a construction project manual for a real construction project.

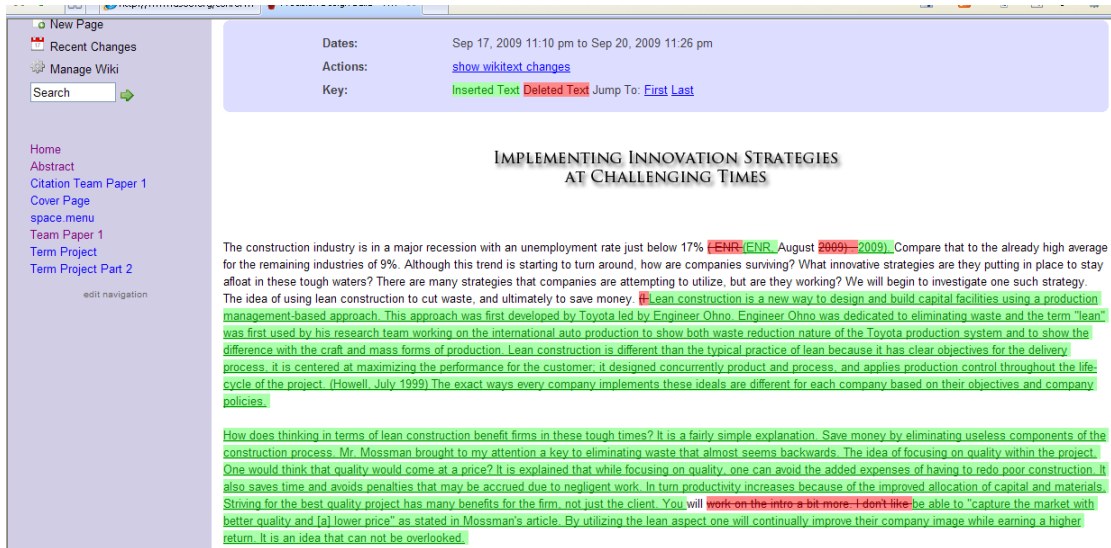


Figure 1 Page Edit History in wiki

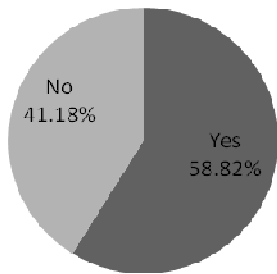
Student survey results

This section reports on the results of the survey with respect to student perceptions on the use of wikis. Students' experiences were positive and their opinions indicate their preference to continue to use wikis. Considering the simplicity of analyses undertaken, most of the results reported here are descriptive statistics and summaries of students' comments. Follow-up interview sessions have been done to clarify interesting aspects of the answers. Seventeen students voluntarily and anonymously completed the questionnaire.

Figure 2 illustrates that 58.82% of respondents believe that using wikis improves the productivity of conducting group assignments. They believed that wikis speeds up the revision process by using page editing history or version controls, which is also a useful function for the instructor because it quickly reveals who contributed on the paper most.

Of the students surveyed, 41.18% of respondents do not think that wikis helped them improve productivity in writing group research papers (Figure 2). Several students mentioned that the school was already equipped with a well-established Local Area Network (LAN), which supports project collaboration. Some of the students wanted to keep the old way of sharing files via LAN because they are already familiar with it. Other students also mentioned that productivity gain was not significant because it takes long time to get everybody trained on how to use the wiki site.

Did Wikis help your group improve productivity on developing a research paper?



Do you like WIKI for developing a research paper with team members?

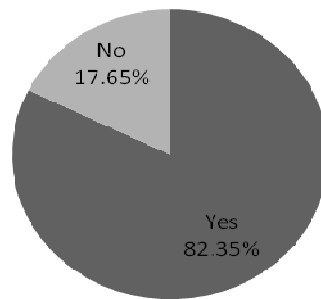


Figure 2 Student perceptions on the use of wikis

Do you want to recommend the use of Wikis in other classes?

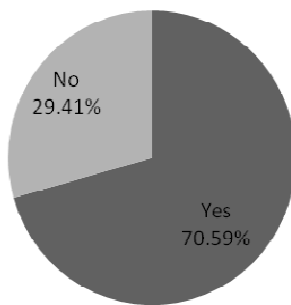


Figure 3 Student Perceptions on the future use of wikis

According to the survey results, 82.35% of students liked to use a wiki for developing a research paper with team members (Figure 2). 70.59% of all respondents would recommend to other classes the use of wikis in future classes. (Figure 3). The follow-up interview also indicated that they particularly liked to receive in-progress feedback from the instructor. Therefore, they have more chances to revise the paper and receive a better grade on it (Figure 3). Follow-up interviews also revealed that team leaders like page editing and login tracking functions in order to keep track of team member's contributions (Figure 4). A peer evaluation process also helps the instructor give appropriate grades to the team members. However, typical peer evaluation processes solely rely on team member ballots. By using the page history, the instructor can validate the peer evaluation results using actual work shown in wiki pages. Five students suggested that the wikis need to improve the quality of text styling and word processing interfaces.

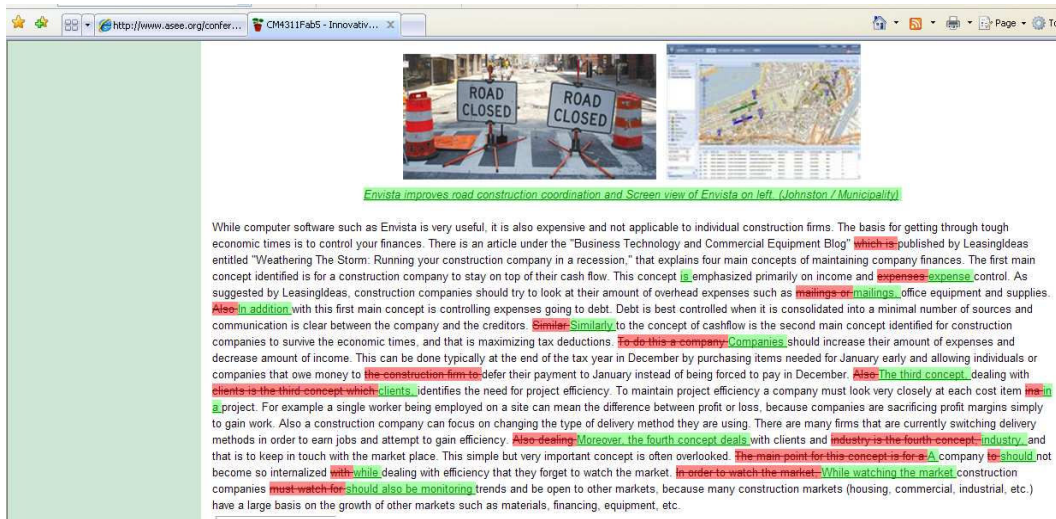


Figure 3 Comparison of two versions of a wiki page

The screenshot shows a wiki page titled "Precision Design Build" with a sub-page "Team Paper 1". The editing history table is as follows:

Date	Compare	Author	Comment
Sep 20, 2009 11:26 pm	select	Jandyman05	
Sep 20, 2009 11:02 pm	select	Jandyman05	
Sep 20, 2009 10:13 pm	select	Glapinse	
Sep 20, 2009 9:28 pm	select	msoesoftball88	
Sep 20, 2009 9:21 pm	select	msoesoftball88	
Sep 20, 2009 9:21 pm	select	msoesoftball88	
Sep 19, 2009 10:17 pm	select	urbancowboy307	
Sep 19, 2009 6:30 pm	select	Jandyman05	
Sep 19, 2009 6:08 pm	select	msoesoftball88	
Sep 19, 2009 2:52 pm	select	msoesoftball88	
Sep 19, 2009 2:51 pm	select	msoesoftball88	
Sep 18, 2009 9:54 am	select	urbancowboy307	
Sep 17, 2009 11:10 pm	select	Jandyman05	
Sep 17, 2009 9:44 pm	select	Jandyman05	
Sep 17, 2009 9:09 pm	select	Glapinse	

Figure 4 Page Editing History

Conclusion

This paper focuses on the use of wikis for collaborative learning and knowledge creation in construction education. The results show that students find their experiences positive, and not only do they prefer to continue using wikis in the future, but they would also recommend other courses to use wikis.

A limitation of the study is the participation of senior CM students only for a short period of time. As this is not a randomly chosen group of the overall student population, the results of our

study might not be generalized directly in construction education. Also, a larger population of students needs to be considered for a more comprehensive study in the future. Some students pointed out that there was not enough time to learn user interfaces in the chosen wiki site. This issue often makes students feel uncomfortable in the use of wikis. The instructors need to give a detail instruction on the use of wikis before employing it in the course. Face-to-face meetings with team members are also needed for students to clarify the contents shared in the wikis.

The results reveal that the students mainly perceive wikis as effective tools for group members who are located in geographically dispersed locations. Wikis are also appropriate tools for online courses or evening courses that have less chance of face-to-face interaction. However, the students still find wikis beneficial because the students typically cannot find ample time to discuss group assignments because the team members often have different course schedules. The authors also found that wikis are an appropriate tool for faculty members to use to develop course materials collaboratively. Oftentimes, faculty members develop procedures, policies, or assessment materials collaboratively. It would be a great tool to write a research paper with other faculty members whose schedules preclude direct face-to-face meetings.

Based on the results of this study, instructors who want to use wikis need to consider the following factors:

1. **Select the right wiki:** There are hundreds of different wikis available for academic use. The task of selecting the right wiki for a class can be difficult. Instructors need to evaluate different wikis based on the course objectives and required features for the proper implementation. Common features include text editing, page history, version controls, and emails. Free wikis often show too many advertisements and limits functionalities for free licenses. Instructors need to research a number of different wikis to find the wiki with the best features for the task at hand.
2. **Opportunities for continuous knowledge building:** Wikis should be used for continuous knowledge building. Instructors need to continue using the same wikis for this effort. Future studies will be conducted for a long-term period to investigate the knowledge building processes using wikis. Students can keep adding or revising wikis that have been constructed from previous students. There is a significant potential for wikis to be used as student project examples or supplemental course materials.
3. **Availability of other collaborative technologies:** Many schools provide several collaborative technologies such as Blackboard™, network storages, or email. Some students are reluctant to use wikis because they feel comfortable with existing technologies. Instructors need to help students understand that the primary goal of using wikis is to collaborate with a wide array of communities and to thus share knowledge.
4. **Use of face-to-face student interaction:** Face-to-face meetings need to be conducted to increase team interaction. Relying upon wikis alone will not produce an optimal product.

There are also several issues that must be addressed with the use of these technologies in the classroom. A comprehensive administrative policy must be developed to set guidelines for the students on the use of an open information sharing technology, such as a wiki, that may be used as part of their learning experience. The possibility of academic dishonesty and corruption of

these technologies is a legitimate concern and must be addressed by the faculty using the KMS, and by the University administration before it can be safely implemented in the classroom.

This paper also suggests future research needs to be completed in the development of a framework on how to properly use, monitor, and assign a grade to this type of application. Also, further study must be completed on the use of other knowledge sharing tools such as blogs and podcasts in order to optimally present and use these technologies, and to expose the students to tools that may be used in their professional careers after graduation.

List of References

1. Chao, J. (2007). Student Project Collaboration using Wikis. *Proceedings of the 20th Conference on Software Engineering Education & Training*. Dublin, Ireland.
2. Duffy, P. and Bruns, A. "The use of blogs, wikis and RSS in education: A conversation of possibilities." *Proceedings of the Online Learning and Teaching Conference 2006*, pgs. 31-38, Brisbane.
3. Ebner, M., Kickmeier-Rust, M., and Holzinger, A. "Utilizing wiki-Systems in higher education classes: a chance for universal access?" *Universal Access Information Society*, no. 7 (2008): 199-207.
4. Egbu, C and Botterill, C. "Information technologies for knowledge management: their usage and effectiveness." *Special Issue ICT for Knowledge Management in Construction*, Vol. 7 (2002): pgs. 125-137.
5. Evans, P. "The wiki Factor." *BizEd*, January/February (2006), 28-32. Retrieved December 2009 from <http://www.aacsb.edu/publications/Archives/JanFeb06/p28-33.pdf>
6. Mills, T. "wiki-based Construction Knowledge Sharing." *The ASC Annual Conference Proceedings, Associated Schools of Construction (2007)*, Flagstaff, AZ.
7. Parker, K. and Chao, J. "wiki as a teaching tool." *Interdisciplinary Journal of Knowledge and Learning Objects* 3 (2007): 57-72.
8. Wikipedia. (n.d.). *Wiki*. Retrieved January 20, 2010, from Wikipedia: <http://en.wikipedia.org/wiki/Wiki>