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Title: Using online collaborative tools for groups to co-construct knowledge

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Abstract (limit 250 words)

Purpose

This paper reports and describes the use of MediaWiki and Google Docs at undergraduate level as online collaboration tools for co-constructing knowledge in group project work.

Design/methodology/approach (limit 100 words)

Participants included twenty-two undergraduate students from the Information Management program at The University of Hong Kong. All students have used (1) MediaWiki for the major project in their Knowledge Management course and (2) Google Docs for their final year project. Questionnaires and semi-structured telephone interviews were administered after completion of the course / final year project. All interview conversations were audio recorded and transcribed for analysis. Each interview transcript was emailed to the corresponding respondent for accuracy review. The qualitative data supplemented enriched and clarified the quantitative responses from the online surveys.

Findings (limit 100 words)

Results indicated positive experiences from using the tools for online collaboration in the group projects for some of the students. Although more students found MediaWiki an effective knowledge management tool than Google Docs, many students highlighted the user-friendly features of Google Docs.

Originality/value (limit 100 words)

These platforms (MediaWiki and Google Docs) gave teachers the facility to closely monitor student progress, and to provide feedback to assist in the effective management of the report-writing process. **Besides, the use of Google Docs in an academic setting remains largely unexplored in the literature even though the collaborative features of MediaWiki and Google Docs are relatively comparable.**

This paper reports and describes the use of MediaWiki and Google Docs as online collaboration tools for co-constructing knowledge in a group project. Undergraduate Information Management students used MediaWiki and Google Docs as collaboration tools for carrying out two separate projects. We assessed and compared students' perception on the effectiveness of MediaWiki and Google Docs after the completion of the projects. Results indicated positive experiences from using the tools for online collaboration in the group projects for some of the students. Although more students found MediaWiki an effective knowledge management tool than Google Docs, many students highlighted the user-friendly features of Google Docs.

1. Introduction

In today's global economy, collaboration has become an essential skill necessary for effective functioning in society. The emergence of Web 2.0 has been heralded as a tool for facilitating collaboration. Examples of Web 2.0 technologies include Twitter, Facebook, MySpace, Wikis, Google Docs, and blogs which allow the exchange of thoughts via the Web without restrictions of time or place.

One of the most popular Web 2.0 technologies is Wiki, which has shown much promise in promoting communication, collaborative authoring, and information sharing (Parker, 2007; Ravenscroft, 2009; Trentin, 2009). There are many examples of Wiki applications (e.g., Wikidot, Mediawiki, PBWiki) that have been spawned since the launch of Wikipedia in 2002. Wikis are characterized by simplicity, accessibility, and interoperability^a. They combine the functionality of a word processor and a web browser. As long as a computer with internet access is available, web users are able to create and edit the content of Wiki pages collaboratively without the technical knowledge normally required for writing HTML code. Similar functionality is also provided with Google Docs. Google Docs, another Web 2.0 technology, is a free web-based application that allows users to create and to share online documents, spreadsheets, presentations, and forms. Similar to Wikis, Google Docs allows concurrent online editing and collaboration for knowledge building by multiple users. These applications have the potential to alter the educational experience of students.

In recent years, education has been undergoing a shift from teacher-centered and instruction-based curriculum implementation to student-centered and inquiry-based learning (Chu et al., 2008; Hmelo-Silver, Duncan, & Chinn, 2007). Students are routinely required to engage in collaborative learning activities such as group projects, presentations, group discussion, and peer evaluation that require significant collaboration and communication with classmates. Among all available Web 2.0 applications, choosing a suitable online platform to facilitate collaboration with and among students could be a difficult task for a course instructor. In this study, we assessed and compared the perceived effectiveness of two particular Web 2.0 applications Google Docs and MediaWiki to support collaborative learning in the group projects of undergraduate students. While appearing to be fundamentally different, both tools facilitate collaboration, include a history function for both document revisions and information about who made the changes, and are relatively simple for students to implement and use. Results could provide useful information for course instructors in selecting an appropriate online platform for facilitating students' collaboration.

2. Literature Review

2.1 Collaborative learning and knowledge management

Collaborative learning has always been an important strategy to use in classroom teaching (Coyle, 2007; Oxford, 1997). Collaborative learning refers to tasks that require joint intellectual efforts among students or between students and teachers. In most instances, this involves students working in groups to co-construct an artifact (e.g., report or presentation) for assessment (Smith & MacGregor, 1992). More specifically, it also involves social interactions as small groups of students solve an academic problem together (Alavi, 1994). As a learning strategy, it emphasizes social and intellectual interaction in the learning process such that the differences in knowledge, skills, and attitudes among collaborators become strengths rather than weaknesses (Hartley, 1999). Knowledge is shared and acquired during communication, negotiation, and production of materials (Gros, 2001; Smith & MacGregor, 1992). Through collaborative learning, learners have the opportunity to equip themselves with stronger analytical skills for interpreting information and acquiring further knowledge (Lowyck

^a —The ability of systems to exchange and make use of information in a straightforward and useful way; this is enhanced by the use of standards in communication and data format." (A Dictionary of Computing, 2008).

& Poysa, 2001). In return, they contribute by co-constructing and sharing knowledge within their learning community (Scardamalia & Bereiter, 2006).

Knowledge construction and sharing are among the processes involved in knowledge management (Dalkir, 2005). Recent research illustrates that effective knowledge management is able to enhance teaching and learning in a higher education setting (McCarthy, 2006). Scardamalia and Bereiter (2006) argued that the main purpose of acquiring knowledge was to induce further knowledge creation. The SECI model (a four stage process of socialization, externalization, combination, and internalization) for knowledge creation of Nonaka and Takeuchi (1995) has provided a model for a considerable amount of research on knowledge management in education. Nonaka and Takeuchi (1995) argued that knowledge creation is a spiral process of interactions between explicit and tacit knowledge in this four-stage process. While collaborative learning has been seen to result in co-construction of shared knowledge (Jeong & Chi, 1997), knowledge co-construction is a series of collaborative activities that lead to the development of a shared understanding of concepts (Lipponen, 2002). Knowledge sharing links individual knowledge users such that knowledge resides and attains its value within the community (Hendriks, 1999). Factors such as the quality and depth of the student interactions, together with the communications tools used often affect the effectiveness of knowledge construction and sharing (Veerman & Veldhuis-Diermanse, 2001).

2.2. Wikis

The use of Web 2.0 technologies has the potential to harness cyberspace in a more interactive and collaborative manner, increasing individuals' social interactions and active engagement (Murugesan, 2007). Among Web 2.0 technologies, the Wiki family is considered the poster child example (Rollett et al., 2007) and has been described as an ideal online platform for collaborative projects (Engstrom & Jewett, 2005). The web-based open-editing functions of Wikis allow a relatively low-cost knowledge creation process (Stivilia, Twidale, Smith, & Gasser, 2008). Wikis are easy to use because they do not require additional software and are easily accessible (Desilets et al., 2005). Wiki users can create wiki pages and fill them with a variety of content (e.g., text, images, graphs, maps). They can then edit the content as needed or desired (Raitman et al. 2005), while application tracks the revisions made. Through the use of a wiki, groups of people with a common goal can work collaboratively and simultaneously on a project by jointly creating one single (potentially) hypertext document, thus facilitating knowledge construction (Fuchs-Kittowski & Kohler, 2005). The Wikipedia is perhaps the most influential wiki-based web project. Wikipedia is now one of the most commonly used encyclopedias in the world (Richardson, 2009). Thousands of web users have volunteered their time in co-authoring this high-quality encyclopedia in their native language (Tapscott & Williams, 2006). However, unlike any other encyclopedia, Wikipedia is not annually reviewed by appointed reviewers but reviewed when seen fit by peers (Long, 2006). An investigation conducted by Nature in 2005 has shown that information accuracy of Wikipedia came close to the professionally developed Encyclopaedia Britannica in that 162 errors were found in Wikipedia while 123 errors were identified in Encyclopaedia Britannica (Leadbeater, 2009).

The characteristics of a wiki as a shared tool fit well with the processes associated with collaborative learning and knowledge management. In the education domain, web-based environments are used for joint problem-solving, knowledge building and sharing (Nevgi et al., 2006) where learners are able to practice, collaborate, reflect critically, negotiate, and build consensus similar (but not the same) to that of a face-to-face setting (Liaw et al., 2008). Applications of Wikis also involve aspects of course management and support distance education (Bold, 2006; Parker & Chao, 2007), while the use of a constructivist pedagogy has resulted in considerable benefits to students (Richardson, 1998).

Previous research in education has focused on four major areas: the rationale for using wikis, collaborative learning and writing, knowledge building and management, and sharing and structuring of information (Bold, 2006; Bruns & Humphreys, 2007; Changwatchai, 2005; Chu, 2009; Chu, 2008;

Coyle, 2007; De Pedro et al., 2006; Engstrom & Jewett, 2005; Fountain, 2007; Jones, 2008; Long, 2006; Nicol et al., 2005). The research literature provides evidence that wikis provide useful platforms for collaborative learning activities at different education levels and in different subject areas (Lamb & Johnson, 2007), including heightened accessibility and effective collaboration between tertiary students through their use (Bold, 2006; Chu, 2008; Coyle, 2007; Nicol et al., 2005). For example, Augar, Raitman, and Zhou (2004) utilized MediaWiki to enhance social interaction with an icebreaker assignment. Bruns and Humphreys (2005) also adopted MediaWiki for developing an encyclopedia in an undergraduate course to provide a non-linear approach at documenting the multi-faceted evolution of new media technologies. Such collaborative work experience possibly helps enhance students' critical thinking skills and creativities, which are essential abilities for excelling in their future workplaces of this networked economy.

MediaWiki was chosen for this study because it supports user authentication, signature tool access, and sophisticated editing. Moreover, it is an open source platform with a stable development status, and a wide assortment of features that are adaptable to different purposes (Kasemvilas & Olfman, 2009).

Despite the benefits mentioned, there have also been discussions about the potential pitfalls associated with the use of wikis in education. Rollett et al. (2007) noted the uncertainties in providing stable services of Web 2.0 technologies by start-up companies. In addition, some applications and functions of a wiki may be disabled when it is installed on private servers owned by schools or universities. In order to maximize the benefits of using wikis in education, existing teaching practices and learning beliefs may also need to be revised (Thompson, 2007). For example, the traditional framework that only involves scheduled classes may need to recognise that considerable student work may be accomplished outside normal class times, requiring a different strategies for teachers to manage the process and provide feedback. Clearly there needs to be recognition by teachers that the use of wikis in educational settings needs to be managed carefully. Effective implementation would seem to rely on understanding the balance between the strengths and weaknesses associated with the affordances of wikis, and the relationship between face-to-face and online student experiences.

2.3. Google Docs

Another Web 2.0 technology that has the potential to promote collaboration is Google Docs. Combining a suite of tools including web-based word processor, presentation, spreadsheet, and online forms, Google Docs allows its users to work on collaboration projects by importing existing documents or creating new documents effectively and flexibly (Thompson, 2008). This suite of tools allows multiple authors to edit a document stored on a Google repository by using a simple browser-based editor simultaneously (Dekeyser & Watson, 2006; Skaf-Molli, Ignat, Rahhal & Molli, 2007). Users can contribute and fine-tune the contents while simultaneously allowing others to read the existing material and the changes as they are made (Thompson, 2008).

To get started with Google Docs, users must first create an account and then a document. They can then invite others to collaborate, assigning rights to update or edit the document. Changes to a document are automatically uploaded and saved to the server. Extensive revision histories are also maintained by the Google server, and authors can view the article as it appeared at any time in the past. Google Docs is relatively simple to use, relying on a WYSIWYG interface that doesn't require knowledge of special (as for Wikis) commands (Dekeyser & Watson, 2006). Multiple authors can create and edit documents, spreadsheets, and presentations in real-time using this tool, with all changes saved automatically on the Google (Skaf-Molli *et. al*, 2007). There is considerable potential for Google Docs to serve as a platform for collaborative work. However, empirical evidence of the impact on online collaborative work is yet inadequate as much of the research focus has been on

Wiki's, which require users to learn syntax, rather than the simpler approach adopted by Google Docs.

2.4. Research gap

A considerable amount of recent research has discussed the factors that may support Wikis as collaborative learning tools in education, and some have explicitly focused on the use of Wikis in completing group projects (Bold, 2006; Parker & Chao, 2007). However, the use of Google Docs in an academic setting remains largely unexplored in the literature even though the collaborative features of MediaWiki and Google Docs are relatively comparable. Considering that these are two freely available platforms, it would be useful for educators to investigate how these two newly developed collaborative tools may facilitate students' learning, and to determine their suitability for educational use. This paper investigates the effectiveness of both MediaWiki and Google Docs as online collaboration tools for the co-construction of project report by undergraduate information management students.

3. Research Method

The main research objectives of this study were to:

- (i) evaluate if MediaWiki was perceived as an effective online collaboration tool;
- (ii) evaluate if Google Docs was perceived as an effective online collaboration tool; and
- (iii) compare the perceived effectiveness of MediaWiki and Google Docs.

Twenty-two undergraduate students from the Information Management program at the Faculty of Education (The University of Hong Kong) were invited to participate in the study. Students in this program were exposed to a wide range of information management topics and the latest technologies. A web-based course system along with various electronic activities was designed for students to access course resources and to enrich their learning experiences. Given the amount of exposure in information technology, students from the Information Management program were expected to possess the sufficient level of IT skills to learn and use MediaWiki and Google Docs adequately.

All students have used (1) MediaWiki for the major project in their Knowledge Management course and (2) Google Docs for their final year project. Students received a 30- to 60-minute introductory class on MediaWiki and Google Docs prior to the two projects respectively. In the project for the Knowledge Management course, students worked in groups of five to six people to produce a report on a near-miss analysis for traffic accident prevention using MediaWiki as the means of producing a final report. The report was 3,000 - 4,000 words, with appendices limited to a maximum of 1,000 words. The structure of the report and a suitable Wiki template were provided by the course instructor (the first author). In the final year project, students worked individually or in groups of two to three people, and reports were authored using Google Docs. Although templates were not provided in this instance, the content structure and the evaluation criteria were provided to students via a word document by the course instructor (the second author). Collaboration was strongly encouraged in these projects, including a requirement for a personal journal reflecting on the project and the student's experience. Based on these project experiences, students were invited to complete an online questionnaire that looked at specific usability issues of MediaWiki and Google Docs on a voluntary basis.

All students agreed to participate in the project and written consent were obtained. They were asked to complete the survey after they had submitted their final year projects in May 2009. Given their course requirements, the students were assumed to have sufficient exposure to MediaWiki and Google Docs prior to the completion of the survey. The questionnaire was designed to evaluate

students' perceptions on the effectiveness of the use of Google Docs and MediaWiki as collaborative tools for group projects. More specifically, the questionnaire focused on three aspects of Google Docs and MediaWiki: usage experiences, the extent and severity of potential problems, and knowledge management. The questionnaire was administered online using SurveyMonkey (<http://www.surveymonkey.com>), and students were provided with instructions for accessing and completing the survey. The survey included questions with 5-point Likert scale where a response of 1 corresponded to —Not at all, and a response of 5 corresponded to —Very much so. A comment box was also available after each question in order to provide students with the opportunity to comment further if desired. Open-ended questions were also included to ask students for their overall comments and for clarifying issues not addressed by the Likert-style questions. Questions regarding the affordances and student experience of MediaWiki and Google Docs were almost identical. Twenty-one responses were received. Responses from six students were excluded because these students worked individually on their final year project. A response received from a student who did not belong to this particular cohort was also excluded. Therefore, the final sample consisted of fourteen (n=14) students.

In addition to the online survey, semi-structured telephone interviews were conducted with the participants in January 2010. Each interview lasted for about 5 to 10 minutes. The participants were asked to comment on the online platform that they preferred to use, and how their preferred online platform had assisted them in their group projects. Out of 14 students, a total number of 8 students were interviewed. All interview conversations were audio recorded and later transcribed for analysis. To ensure the accuracy of the transcription, each interview transcript was emailed to the corresponding respondent for review. The qualitative part of this study served as supplement to enrich and clarify the quantitative responses from the online surveys.

Quantitative data from close-ended questions were analyzed using PASW Statistics 17. Non-parametric methods were used in the quantitative analysis due to the small sample size and the Likert scale data structure. The responses to the open-ended survey questions and the contents of the telephone interviews are also discussed.

4. Findings and Discussion

An overview of the inherent similarities and differences between MediaWiki and Google Docs from the course instructor's perspective was first discussed. Then, students' rating on MediaWiki and Google Docs in terms of usage experience, severity of potential problems, and knowledge management were analyzed. For each of these aspects, we first evaluated the tools separately by examining the descriptive statistics. Then we compared the results of the two tools using Wilcoxon signed ranks tests. The qualitative data obtained from the telephone interviews is presented at the end of this section to further clarify the quantitative data.

4.1 Comparing the similarities and differences between Google Docs and MediaWiki

With one being a hypertext and one carrying many features of a conventional word processor, both MediaWiki and Google Docs provide electronic platforms for online collaboration in real time. As such, a major similarity of the two tools lies within their collaborative potentials. Both allow simultaneous co-construction or co-authoring of text and information by multiple users on the same document or webpage. The entire editing history is available on both tools. In term of differences, a comparison between the two tools is shown in Table 1. For the major project of the Knowledge Management course, the structure of MediaWiki was instructor-driven that the course instructor with the help of the professional technical staff initiated the platform setup. Assignment instructions, reference materials, and sample projects were provided in the corresponding sections of the platform. The instructor also designed a template for the project, although students were allowed to tailor the

template according to their specific needs. Although an intranet setting was available on MediaWiki, the project pages were configured to allow public access. In contrast, the setup of Google Docs for the Final Year Project was student-driven. As Google Docs is a free service for all web users, students were able to set up the Google Docs files for the project on their own. These files were shared among students of the project group only because access to the files was granted by invitations from the files' administrators. Students authorized the instructor to look at their shared files at different time points of the project.

In this study, the course instructor designed and predetermined the structure of a single MediaWiki platform for the Knowledge Management project, while students decided how they organized and managed a collection of Google Docs documents for collaboration on the Final Year Project. With such inherent difference, MediaWiki might be a better tool for monitoring and management since the instructor would know exactly where to look for specific information. For students, the interlinked web pages of MediaWiki could possibly be easier for them to refer to reference materials while writing the project report.

Table 1. Differences between MediaWiki and Google Docs

	MediaWiki	Google Docs
Purpose	A collaborative website that allows easy creation and editing of interlinked web pages via a web browser	A free, web-based word processor, spreadsheet, form, and data storage service that allows users to collaborate online by creating and editing shared documents
Platform setup	Instructor-driven Setup by the instructor and technical staff	Student-driven Setup by students
Interface	Wikipedia-like	MS Office-like
Functionality	Similar to other WYSIWYG web publishing software, with potentials for using syntax to construct the pages by more experienced users	Similar to other office software (e.g. word processors and spreadsheets, and many common Web 2.0 applications (e.g., Facebook))
Progress monitoring	Instructor was able to look at all Students authorized the instructor to activities on the project website Instructor's assignment Students chose which project file(s) to instructions, reference materials, be viewed by the instructor sample projects and feedback were provided on the project website directly	access the project files
Privacy	Intranet or internet setting	Internet setting only

4.2 Usage Experience

Students' usage experience of MediaWiki appeared to be positive. Table 2 reports the descriptive statistics of ratings related to students' usage experience of MediaWiki in their group projects. Ease of use received the highest rating from the students. The mean and median ratings on most of the parameters leaned towards the positive side of the scale, indicating that the students have generally favorable opinions and experiences on the use of MediaWiki in their projects.

The suitability of MediaWiki for students' co-construction of group projects leaned towards the positive findings. In terms of having a user-friendly layout, the mean and median ratings stood below the midpoint of the scale with high standard deviation. It appears that the students did not find the layout of MediaWiki to be favorable for their use.

Table 2. Descriptive Statistics: ratings related to students' usage experiences of MediaWiki in group projects

	Mean (SD)	Median	Frequency				
			(1)	(2)	(3)	(4)	(5)
Improvethethecollaboration among group members	3.50 (.76)	3.50	0	166			1
Helps improve the quality of your group report	2.79 (.89)	3.00	1	4	6	3	0
Easy to use	3.50 (.94)	4.00	1	0	5	7	1
Enjoy working on group project using MediaWiki	3.21 (.89)	3.00	1	0	9	3	1
User-friendly layout	2.64 (1.15)	2.00				5	0
A suitable tool for students to co- construct group projects online	3.43 (.852)	3.00				8	0

Note: 1 indicates —Not at all, 5 indicates —Very much so.

Table 3 provides the descriptive statistics on the ratings related to students' usage experience of Google Docs in their group projects. In general, students found Google Docs easy to use. Similar to MediaWiki, ease of use also received the highest ratings from the students. User-friendly layout came next in students' ratings. However, the median ratings of enjoyment and suitability for co-construction of group projects were at the midpoint of the scale, while their mean ratings were slightly below the midpoint. The mean and median ratings for improvement of collaboration among group members and improvement of group report quality were also slightly lower than the midpoint of the scale.

Table 3. Descriptive Statistics: ratings related to students' usage experiences of Google Docs in group projects

	Mean (SD)	Median	Frequency				
			(1)	(2)	(3)	(4)	(5)
Improves the collaboration among group members	2.79 (1.31)	2.50	2	5	3	2	2
Helps improve the quality of group report	2.43 (1.02)	2.50	3	4	5	2	0
Easy to use	3.57 (1.28)	4.00	1	2	3	4	4
Enjoy working on group project using Google Docs	2.71 (1.27)	3.00	3	3	4	3	1
User-friendly layout	3.29 (1.39)	3.50	2	2	3	4	3
A suitable tool for students to co-construct group projects online	2.86 (1.23)	3.00	2	4	3	4	1

Note: 1 indicates —Not at all, 5 indicates —Very much so.

Table 4 shows the comparisons between the ratings on Google Docs and MediaWiki for items related to usage experience using Wilcoxon signed rank tests. Results showed no significant differences between Google Docs and MediaWiki. However, MediaWiki seemed to receive higher ratings when the raw means were compared. Furthermore, the standard deviations of the responses on Google Docs were bigger, indicating that the opinions on its usability were more varied and, thus, less conclusive. Nevertheless, it is worth noting that, although it had much lower mean and median ratings on suitability, Google Docs received a much higher rating on user-friendly interface. This could be explained by the fact that many of the features of Google Docs are similar to other commonly used word processors. On the other hand, the higher exposure to MediaWiki could explain the more favorable ratings on MediaWiki. Students completed their KM project using MediaWiki before their Final Year Project using Google Docs. So the students may have had more opportunities to use MediaWiki in other settings than Google Docs before completing the online survey.

Table 4. Comparison on students' usage experiences in using Google Docs and MediaWiki: Wilcoxon signed ranks tests

	Mean (SD)		Z	Asymp. Sig (2-tailed) *p < .05
	MediaWiki	Google Docs		
Improves the collaboration among group members	3.50 (.76)	2.79 (1.31)	-1.93	.054
Helps improve the quality of your group report	2.79 (.89)	2.43 (1.02)	-1.18	.236
Easy to use	3.50 (.94)	3.57 (1.28)	-.262	.794
Enjoy working on group project using the tool	3.21 (.89)	2.71 (1.27)	-1.64	.100
User-friendly layout	2.64 (1.15)	3.29 (1.39)	-1.59	.111
A suitable tool for students to co-construct group projects online	3.43 (.852)	2.86 (1.23)	-1.87	.062

4.3 Associated Problems

Table 5 shows the ratings related to the perceived severity of problems faced by the students when they used MediaWiki in their projects. Except for privacy issues in posting items, the mean and median values of the ratings for the other parameters ranged from midpoint to the lower end of the scale. Such low ratings indicated that the students did not encounter many problems when using MediaWiki. Based on the open-ended items in the survey, one student explicitly reported problems in text editing due to the limited functionality of MediaWiki. Other projects that have used MediaWiki noted that it has a wide assortment of adaptable features, and the main limitation is the absence of support for threaded discussion (Kasemvilas & Olfman, 2009). However, in our findings, the students did not seem to find the feedback and discussion mechanisms as problematic.

Table 5. Descriptive Statistics: the severity level of the potential problems on using MediaWiki

	Mean (SD)	Median	Frequency				
			(1)	(2)	(3)	(4)	(5)
Creating new pages	2.64 (1.22)	3.00	3	35	2		1
Uploading files	2.29 (1.20)	2.00	5	3	3	3	0
Uncomfortable in editing group members' work	2.79 (1.12)	3.00	2	3	6	2	1
Privacy issues in posting items	3.14 (1.46)	3.00	3	1	4	3	3
Others	2.07 (1.33)	1.50	7	2	3	1	1

Note: 1 indicates —Not at all, 5 indicates —Very much so.

In Table 6 the perceived level of severity of the problems with Google Docs is shown. All means and medians were either equal to or below the midpoint of the scale. However, more students reported editing or formatting problems when using Google Docs compared to MediaWiki. One student indicated that the format of his document changed automatically without notification. Another student found some errors in the format of the document when he opened the document in MS applications. Another reported errors when more than one user edited the same page at the same time.

Table 6. Descriptive Statistics: the severity level of the potential problems on using Google Docs

	Mean (SD)	Median	Frequency				
			(1)	(2)	(3)	(4)	(5)
Creating new pages	2.93 (1.33)	3.00	2	433			2
Uploading files	2.79 (1.31)	2.00	2	6	0	5	1
Sharing files	2.79 (1.19)	3.00	2	4	4	3	1
Uncomfortable in editing group members' work	3.00 (1.24)	3.00	2	2	6	2	2
Privacy issues in posting items	2.29 (.91)	2.00	3	5	5	1	0
Others	2.14 (1.29)	2.00	6	3	3	1	1

Note: 1 indicates —Not at all, 5 indicates —Very much so.

Table 7 provides comparisons between the ratings on Google Docs and MediaWiki for items related to the level of severity of potential problems using Wilcoxon signed rank tests. The rating on problems regarding privacy issues in posting items was significantly higher for MediaWiki than Google Docs. This result was not surprising because the content in the MediaWiki page was made available to all internet users, while only authorized people can view the students' projects kept in Google Docs. The mean rating of potential problems in creating items, uploading files, and feeling uncomfortable in editing group members' work of Google Docs were higher than MediaWiki, although the differences were not statistically significant.

Table 7. Comparison on the severity level of potential problems in using Google Docs and MediaWiki: Wilcoxon signed ranks tests

	Mean (SD)		Z	Asymp. Sig (2-tailed) *p < .05
	MediaWiki	Google Docs		
Creating items	2.64 (1.22)	2.93 (1.33)	-.79	.43
Uploading files	2.29 (1.20)	2.79 (1.31)	-1.47	.14
Feeling uncomfortable in editing group members' work	2.79 (1.12)	3.00 (1.24)	-.72	.74
Privacy issues in posting items	3.14 (1.46)	2.29 (.91)	-2.14	.03*
Others	2.07 (1.33)	2.14 (1.29)	-.58	.56

4.4 Knowledge Management

Table 8 shows the descriptive statistics of students' evaluation of MediaWiki as an effective knowledge management tool in terms of knowledge creation, knowledge capturing, and knowledge sharing. All three ratings showed strong positive tendency that most students gave ratings of —3| or —4|. The means for all three items were higher than the midpoint of the scale.

Table 8. Descriptive statistics: MediaWiki as a knowledge management tool

	Mean (SD)	Median	Frequency				
			(1)	(2)	(3)	(4)	(5)
Knowledge creation	3.29 (.83)	3.00	1	0	7	6	0
Knowledge capturing	3.07 (.73)	3.00	1	0	10	3	0
Knowledge sharing	3.36 (.93)	3.00	1	0	7	5	1

Note: 1 indicates —Not at all, 5 indicates —Very much so.

The results for Google Docs seemed to be less conclusive than the results for MediaWiki. Table 9 reports the descriptive statistics of students' evaluation on Google Docs as an effective knowledge management tool in terms of knowledge creation, knowledge capturing, and knowledge sharing. The ratings on these three items were more widely spread (i.e. higher standard deviation) across the scale than the ratings on the same items of MediaWiki. All median values were equal to the midpoint of the scale, while the mean ratings on knowledge capturing and knowledge sharing were all on the positive side.

Table 9. Descriptive statistics: Google Docs as a knowledge management tool

	Mean (SD)	Median	Frequency				
			(1)	(2)	(3)	(4)	(5)
Knowledge creation	2.93 (1.33)	3.00	2	4	3	3	2
Knowledge capturing	3.07 (1.07)	3.00	1	3	5	4	1
Knowledge sharing	3.14 (1.23)	3.00	1	4	3	4	2

Note: 1 indicates —Not at all, 5 indicates —Very much so.

Table 10 shows the comparison of the ratings of knowledge management for MediaWiki and Google Docs. MediaWiki received higher ratings as an effective tool in enabling knowledge creation and knowledge sharing compared to Google Docs, although such differences were not statistically significant.

Table 10. Comparison on knowledge management of Google Docs and MediaWiki: Wilcoxon signed ranks tests

	Mean (SD)		Z	Asymp. Sig (2-tailed) *p < .05
	MediaWiki	Google Docs		
Knowledge creation	3.29 (.83)	2.93 (1.33)	-1.22	.22
Knowledge capturing	3.07 (.73)	3.07 (1.07)	.00	1.00
Knowledge sharing	3.36 (.93)	3.14 (1.23)	-.79	.43

4.5 Telephone interview

In the semi-structured telephone interviews, some students indicated preferences on using Google Docs in their group projects. The user-friendly nature of Google docs and its relative convenience in information sharing were highlighted as strengths by these students. In addition, Google Docs was perceived to be less complicated than the other online platform tools as its operations and commands were simpler to perform. For example,

—Because *Google Docs is developed by Google, and there are a lot of people around using Google mail, we can easily share files and it is also more user-friendly and more interactive*, I said Student AD.

—*It is more convenient because we can use the 'sharing files' function and it enables my group mates and I to share all the documents*, I said Student ED.

—*Instant interactions were enabled as we were able to engage in discussion via Google Docs, also it allows us to share any files that we find interesting with our group mates instantly. And I also think that the commands for Google Docs are easier to operate, and it is more user friendly as compared to MediaWiki*, I said Student MF.

Other students indicated preferences on using MediaWiki with the following reasons:

—*MediaWiki has a special function whereby every time you make some changes, there will be a record saved. I personally feel that this function is very good as I am able to see my work in the past, and comparison can be*

made. I think this is the best function of MediaWiki. Whenever any of the group members made any changes, it is easy to track and check, said Student SY.

—I think the point is that it enables us to access directly our group mates' files and we are able to do corrections immediately, said Student IV.

5. Conclusion and Implications

In this study, we surveyed students regarding their project experiences in using MediaWiki and Google Docs in terms of usage experience, perceived severity of potential problems, and knowledge management through an online questionnaire. We aimed to evaluate students' perception on whether MediaWiki and Google Docs are effective online collaboration tools. In addition, we compared the perceived effectiveness of MediaWiki and Google Docs for knowledge management and collaboration. Results revealed that the majority of students found MediaWiki and Google Docs easy to use with user friendly layouts. The potential problems identified in the study did not seem to be overwhelmingly problematic, although some students indicated privacy concerns and formatting/editing problems in using these tools. Overall, majority of the students perceived MediaWiki and Google Docs to be effective knowledge management tools. More students tended to find MediaWiki more effective for their group projects than Google Docs. But students indicated different reasons on why they preferred MediaWiki or Google Docs in the telephone interview.

Students used MediaWiki and Google Docs for two different collaborative projects over different time periods. Straight comparisons between the two experiences could be difficult to make. Nevertheless, rather than an artificial experiment, the current study presented how the tools were used and compared in a natural setting. Although we did observe some differences in students' ratings on MediaWiki and Google Docs within the particular settings, only a few of these differences were shown to be statistically significant. A possible explanation for these results is most likely related to the small sample size. Future studies should aim at surveying a larger group of users. In addition, participants gave little feedback on sharing their experiences and opinions in the open-ended questions on the survey. As such, the follow-up phone interview with the participants served an important role. Lastly, this study relied on self-report measures. Future studies should aim to include more objective indicators in assessing the effectiveness of MediaWiki and Google Docs as collaborative tools and knowledge management tools.

Despite these limitations, the current study showed that students have positive perceptions on using MediaWiki and Google Docs for group projects. The findings imply that undergraduate students such as the sample in this study may be quite receptive to the use of such online collaborative platforms. The length of time for the students to gain familiarity with such online tools may also be important. The study is preliminary in this area that further investigation is necessary to verify these claims.

Implications for practice and learning

Given the ratings on the perceptual survey and the comments in the interviews, students seemed to be able to operate effectively in teams using more than one type of online collaborative platform. Although they learnt and became familiar with the tools rather easily, frustration arose when things did not work as expected (for example, the import/ export from Google Docs to MS Word documents). In addition, privacy issues in the case of MediaWiki were highlighted, suggesting that students were not comfortable in having their work publicly available. To preserve privacy, course instructors could consider an intranet setting for Wiki platforms in future collaborative projects. The privacy settings in Google Docs are potentially more robust, and allow students to collaborate over the internet without the risk of exposing their work: excepting those people they give either read access only or read-write access to. This study should be seen as a snapshot in time, with both

applications continuing to be developed with more user-friendly interfaces and additional functionality being added constantly.

From the instructor's perspective, both MediaWiki and Google Docs serve as potentially effective tools in managing and monitoring students' collaborative group projects. Both platforms gave the teachers the facility to closely monitor student progress and provide feedback to assist in the effective management of the report-writing process. There was no longer any need to ask for drafts and laboriously write written feedback. Instead, comments could be added in either environment (MediaWiki or Google Docs), thus providing more immediate and more detailed feedback than normal for non-technology supported project work. What this research has shown most clearly is that there are benefits for student learning and monitoring and feedback by the teacher, irrespective of which platform is selected.

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