A triangulated investigation of using wiki for project-based learning in different undergraduate disciplines

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ABSTRACT
This study investigates the use of wiki to support project-based learning (PBL) in 3 undergraduate courses of different disciplines: English Language Studies, Information Management, and Mechanical Engineering. This study takes a methodological triangulation approach that employs the use of questionnaires, interviews, and wiki activity logs. The level of activities and the types of core actions captured on wiki varied among the three groups of students. Students generally rated positively on the use of wiki to support PBL, while significant differences were found on 9 items (especially in the "Motivation" and "Knowledge Management" dimensions of the questionnaire) among students in the three different disciplines. Interviews revealed that these differences may be attributable to the variations in the natures and scopes of the PBL, as well as in the different emphases that students placed on the work presented on the wiki. This study may provide directions on the use of wiki in PBL in undergraduate courses.

Categories and Subject Descriptors
K.3.1 [**Computers and Education**]: Computer Uses in Education – *collaborative learning.*

General Terms
Experimentation, Human Factors

Keywords
Wiki, Education, Project-Based Learning, University

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1. INTRODUCTION
Wikis have been gaining momentum and popularity in the educational field ever since they made their debut in the end of the 1990s [7]. They have been embraced especially for their collaborative potential, with rapidly growing applications in group-based activities across disciplines and levels of study (see [2, 3, 13] for overviews). One particularly popular use of wikis is as a tool for collaborative writing (e.g., [17, 18]). The specific use of wikis varies widely, ranging from story writing among students in the language classroom [11], collaborative glossaries in science education [14] to group report writing in inquiry-based projects [6].

Through the support of the university's Teaching Development Grant, wikis have been implemented in various courses to support PBL in a number of programmes across different faculties: BSc[Information Management], Bachelor of Business Administration, Bachelor of Engineering (Mechanical Engineering), Bachelor of Arts in English, and Postgraduate Diploma in Education. The project aimed to examine factors that support successful adoption of Web 2.0 technologies to optimize students' experiential and capstone learning activities (e.g., group projects and summer internships). Recognition of special needs in specific programs led to tailored support structures.

Among the various implementations, three courses with comparable didactical settings have been chosen [English Language Studies (ENGL), Information Management (BSIM), and Mechanical Engineering (MECH)] for further analysis in this research study. Students from different disciplines may possess different learning self-concepts, and different working styles, which may lead to different perceptions of the collaborative tool. This study aims to compare the use of wiki to support PBL in 3 different courses through adopting a methodological triangulation approach (a questionnaire with multimodal evaluation parameters, interviews with students and lecturers, and wiki activity analysis). As far as we know no such comparison has been described in the literature yet.

2. METHODOLOGY

The main research focus of this study was to understand how undergraduate students perceive and use wiki to support PBL. This has been broken down into two key research questions:

1. What are the students' perceptions of using wiki for collaborative learning?

2. What kinds of activity patterns have been observed on the group project wikis?

2.1 Participants and Research Settings

This study examined the perceptions and activity patterns of using wiki to support PBL in undergraduate courses at a university in Hong Kong. Research participants included students (n = 71) from different disciplines, including ENGL, BSIM, and MECH (ENGL: n = 15; BSIM: n = 22; MECH: n = 34) in 3 courses. Students from each course formed groups and worked on a group project using wiki to facilitate collaboration during the process. Students in ENGL and BSIM were instructed to produce an online project report on the wiki directly. For the Mechanical Engineering course, each group had to design and write a computer program, supplemented with a 20-page project report. The group sizes in the English Language Studies course, Mechanical Engineering course, and Information Management course are 3 to 4, 2 to 3, and 5 to 6 respectively.

Two wiki platforms were used in the study. Google Sites (http://sites.google.com) was used in the ENGL course, while PBworks (http://pbworks.com) was adopted in the two other courses. Both platforms are designed for team collaboration and knowledge sharing. Hands-on workshops were offered to guide students in using the wiki platform.

2.2 Data Collection

2.2.1 Perception of Using Wiki for Collaborative Learning

Students were invited to respond to a questionnaire at the end of the course after having used the wiki for one semester. The questionnaire, composed of 26 items, was constructed based on Hazari, North & Moreland's [8] survey instrument. This instrument attempts to measure students' perception on 4 main factors: Overall Learning, Motivation, Group Interaction, and Technology (see Table 1). For each of the factors, 5 items were presented, using a seven-point Likert scale.

An additional set of 6 items were included in the questionnaire to investigate how students perceive the wiki platform as a tool for enabling knowledge creation, knowledge capturing, knowledge sharing, knowledge dissemination, knowledge acquisition, and knowledge application. This part is regarded as "knowledge management" dimension of the affordance of wiki. A total number of 42 completed surveys were collected from the students (ENGL: n = 8; BSIM: n = 22; MECH: n = 12).

Besides the questionnaire, interviews were conducted with students in ENGL (n = 6) and BSIM (n = 15) participants. The interview aimed to solicit opinions on the affordances and constraints of wiki, and their concepts on collaboration. Interviews with the lecturers were also conducted to have a better understanding of their opinions on using wiki for PBL.

Table 1: Four main factors used in Hazari, North & Moreland's (2009) questionnaire

Factor	Focus of Assessment
Overall Learning	Students' perception of interest in course, retention of material, active learning, and use of course material to meet learning objectives.
Motivation	Students' perception about motivation to use the wiki tool, by investigating criteria such as effort, time, interest, benefits, recommendations, and preferences.
Group Interaction	Students' group interaction, consensus building, collaborative and cooperative learning.
Technology	Students' perception about ease of use, user interface, and technical issues.

2.2.2 Activity Patterns on wikis

The activity patterns on wikis were directly observed from the wiki sites students used during the course. Activities on wiki can be classified into two categories, page modification and commenting. Page modification includes adding, editing, deleting and moving sentences on a wiki page. Commenting refers to text comments or discussions made on a page. Both the Google Sites and PBworks platforms provide detailed revision history logs. All activities, including page content modifications, comment creations, and the identities of the user who made the changes were logged. Besides tracking the number of activities performed by the students, these activities were coded and aggregated for further analysis.

For page modification actions, they were coded and classified according to the taxonomy used by Chu, Lee & King [4], which was derived from the taxonomy by Meishar-Tal and Gorsky [12]. Actions were classified into *adding*, *deleting*, *moving*, *format*, *words*, *images*, and *links*. Comments made by the students were classified using Chu, Lee & King's [4] classification of comments, adapted from Judd, Kennedy and Cropper's [10]. Details of these two coding schemes are presented in Figure 1 and Table 2.

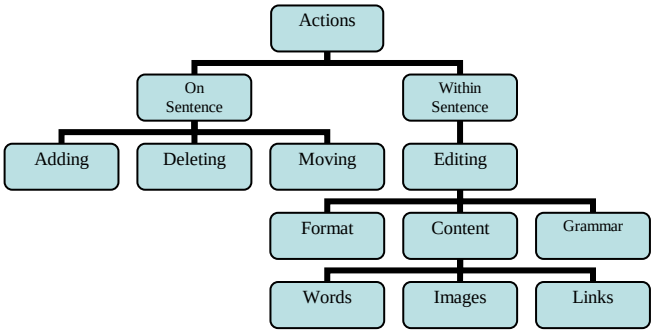

Figure 1. Taxonomy used in classifying page modification actions (Chu, Lee, & King, 2012)

Table 2: Classification of comments (Chu, Lee, & King, 2012)

Category	Description
Content	A comment on the selection, organization, and presentation of ideas.
Form	A comment on the mechanical aspects of writing, such as grammar, spelling, and format.
Work	A comment on the communication and coordination of group work.
Individual	A comment addressed to individual group members.
Group	A comment addressed to the whole group.
Reply	A comment written in response to another comment.

3. FINDINGS

3.1 Perception of Using Wiki for Collaborative Learning

Since the questionnaire was adopted and revised with an addition of 6 new question items, a reliability test was carried out. Internal consistency of the survey was measured by using Cronbach's alpha, and was calculated per factor group. The alpha for Overall Learning is 0.86, the Motivation alpha is 0.85, the Group Interaction alpha is 0.88, and the Technology alpha is 0.88. The group of 6 additional questions has an alpha of 0.91. All groups were found to be in good internal consistency (alpha > 0.8). Overall students' perception of using wiki for collaborative learning was generally positive, with most ratings above the mid-point on the 7-point Likert scale (see Table 3).

Gender of the respondent was not found to be a factor affecting the survey responses using one-way ANOVA. Non-parametric tests were used to compare the responses on questionnaires among students in the three courses. Significant differences ($p < 0.05$) were found on 9 survey items (see Table 4). These items were processed with the Mann-Whitney test as the post-hoc analysis, with Bonferroni correction. The ENGL students (n = 8) have somewhat negative responses to the question items in the *Motivation* factor, despite they were generally positive on the other factors.

Table 3: Students' overall responses to the questionnaire on using wiki for collaborative learning

Survey Items	Mean (SD)			
	All (n=42)	ENGL (n=8)	BSIM (n=22)	MECH (n=12)
Factor: Overall Learning				
Q1. Use of the wiki enhanced my interest in the course	**4.45 (1.38)**	4.00 (1.69)	4.77 (1.38)	4.17 (1.12)
Q2. I would like to see wikis used in other courses	**4.52 (1.40)**	3.63 (1.85)*	4.86 (1.39)	4.50 (0.80)
Q3. I will retain more material as a result of using the wiki	**4.79 (1.14)**	4.88 (1.55)	4.95 (1.13)	4.42 (0.79)
Q4. I participated in the assignment more because of using the wiki	**4.07 (1.58)**	3.75 (1.91)*	4.45 (1.63)	3.58 (1.16)*
Q5. Use of the wiki aided me in achieving course objectives	**4.50 (1.17)**	4.38 (1.60)	4.86 (0.94)	3.92 (1.08)*
Factor: Motivation				
Q6. Benefit of using the wiki is worth the extra effort and time required to learn it	**4.71 (1.13)**	4.88 (1.73)	4.86 (1.08)	4.33 (0.65)
Q7. I would recommend classes that use wikis to other students	**4.76 (1.27)**	4.25 (1.58)	5.14 (1.28)	4.42 (0.79)
Q8. I would prefer projects that use wikis over other projects that do not use wikis	**3.98 (1.30)***	2.75 (1.49)*	4.50 (1.10)	3.83 (0.94)*
Q9. I will continue to explore use of wikis for project-works	**4.48 (1.13)**	4.00 (1.85)	4.73 (0.98)	4.33 (0.65)
Q10. I stayed on the task more because of using the wiki	**4.17 (1.38)**	2.88 (1.46)*	4.59 (1.30)	4.25 (0.97)
Factor: Group Interaction				
Q11. I liked seeing other students' interaction with material I posted in the wiki	**4.60 (1.33)**	4.38 (2.00)	5.00 (1.11)	4.00 (0.95)
Q12. Use of the wiki for the assignment helped me interact more with students	**4.40 (1.38)**	3.75 (1.58)*	4.77 (1.31)	4.17 (1.27)
Q13. Because of using the wiki, my group was able to come to a consensus faster	**4.29 (1.18)**	3.38 (1.51)*	4.55 (1.01)	4.42 (1.00)
Q14. I learned more because of information posted by other students' in the wiki	**4.69 (1.10)**	4.88 (1.55)	4.86 (0.99)	4.25 (0.87)
Q15. Use of the wiki promoted collaborative learning	**4.98 (1.32)**	4.75 (1.58)	5.36 (1.26)	4.42 (1.08)
Factor: Technology				
Q16. The wiki interface and features were overall easy to understand	**4.60 (1.25)**	5.13 (0.83)	4.82 (1.18)	3.83 (1.34)*
Q17. Benefits of using the wiki outweighed any technical challenges of its use	**4.43 (1.13)**	4.75 (1.39)	4.59 (0.85)	3.92 (1.31)*
Q18. Browsing/editing information in the wiki was easy	**4.50 (1.49)**	5.25 (1.91)	4.68 (1.25)	3.67 (1.30)*
Q19. Compared to other online discussion board, the wiki was easier to use	**4.60 (1.40)**	4.88 (1.13)	4.82 (1.22)	4.00 (1.76)
Q20. Technical features in the wiki helped enhance my learning	**4.38 (1.31)**	3.62 (2.00)*	4.68 (1.09)	4.33 (0.98)
Knowledge Management				
Q21. Wiki is enabling for knowledge creation	**4.50 (1.09)**	4.00 (1.51)	4.77 (1.07)	4.33 (0.65)
Q22. Wiki is enabling for knowledge capturing	**4.83 (1.10)**	5.37 (1.06)	5.09 (1.11)	4.00 (0.60)
Q23. Wiki is enabling for knowledge sharing	**5.21 (1.05)**	5.63 (0.92)	5.41 (1.14)	4.58 (0.67)
Q24. Wiki is enabling for knowledge dissemination	**5.14 (1.00)**	5.75 (1.04)	5.27 (1.03)	4.50 (0.52)
Q25. Wiki is enabling for knowledge acquisition	**5.02 (1.05)**	5.50 (0.76)	5.23 (1.02)	4.33 (0.98)

Q26. Wiki is enabling for knowledge application	**4.71 (1.15)**	5.13 (0.99)	4.77 (1.11)	4.33 (1.30)

Notes: *Ratings are based on a 7-point Likert scale: 1 – "Strongly disagree" and 7 – "Strongly agree".*

** Mean score below mid-point.*

Table 4: Items that students from different courses answered differently (Kruskal-Wallis p < 0.05)

Survey Items	Mean			Sig. (Kruskal-Wallis)	Significant Differences Found between Groups (Mann-Whitney Sig.)
	ENGL	BSIM	MECH		
Q5. Use of the wiki aided me in achieving course objectives	4.38	4.86	3.92	0.040	**BSIM-MECH** (0.012)
Q8. I would prefer projects that use wikis over other projects that do not use wikis	2.75	4.50	3.83	0.012	**ENGL-BSIM** (0.008)
Q10. I stayed on the task more because of using the wiki	2.88	4.59	4.25	0.011	**ENGL-BSIM** (0.006)
Q16. The wiki interface and features were overall easy to understand	5.13	4.82	3.83	0.038	(p > 0.017) *
Q18. Browsing/editing information in the wiki was easy	5.25	4.68	3.67	0.024	**ENGL-MECH** (0.016)
Q22. Wiki is enabling for knowledge capturing	5.37	5.09	4.00	0.002	**ENGL-MECH** (0.005) **BSIM-MECH** (0.001)
Q23. Wiki is enabling for knowledge sharing	5.63	5.41	4.58	0.012	**BSIM-MECH** (0.011)
Q24. Wiki is enabling for knowledge dissemination	5.75	5.27	4.50	0.004	**ENGL-MECH** (0.010) **BSIM-MECH** (0.006)
Q25. Wiki is enabling for knowledge acquisition	5.50	5.23	4.33	0.003	**ENGL-MECH** (0.010) **BSIM-MECH** (0.003)

** With Bonferroni correction, the critical value for significance in the Mann-Whitney post-hoc tests is 0.017.*

Another observation worth noting is the responses from the MECH students (n = 12) in the *Technology* factor. The MECH students did not perceive the wiki to be easy to understand, browse, and edit; whereas the ENGL students perceived themselves to be proficient in using the wiki. In general, the MECH group gave lower ratings than the other groups (significant differences on 6 items), and the mean scores tended to gather around the mid-point of the scale. The dispersion of the MECH scores was also comparatively lower than the other groups.

To study more in depth about the discrepancies noted from the questionnaires, interviews with students were conducted. Some ENGL respondents perceived that using wiki was "tedious" (EN1), "redundant" (EN6) and "time consuming" (EN5, EN6). One student responded that he preferred the traditional way to co-construct the group work since "using the wiki gave us more workload" (EN1). Some students considered the wiki tool as an alternative to a word processor with better functions for including multimedia elements, such as Youtube videos (EN2, EN4). Another student commented that "the use of wiki in this course made it different", and "it proved to be a fun-filled project" (EN7). The wiki was perceived as "a presentation tool" (EN5) and "a simple tool for constructing a website" (EN6). Apart from these responses, 4 respondents noted that it was quicker and more convenient to show their work to the group mates using the tool instead of sending emails (EN1, EN2, EN3, EN4). The perception of wiki being a tool which facilitates communication in group work is consistent with the findings from Chu et al.'s previous study on wikis in collaborative learning [5].

For the BSIM interview respondents, 6 students (BS1, BS2, BS5, BS6, BS7, BS11) perceived the wiki as a platform for more efficient information sharing, and it enabled more interaction among students. One student commented that "we have more opportunities to read information collected by different teammates" (BS5). Diverse opinions were found on the perception of using wiki for communication. 4 students stated that it was more efficient to communicate on the wiki using the comment function than sending emails (BS2, BS3, BS5, BS12). However, one student noted that "some students did not leave any constructive comments except phrases like *good job*" (BS6). In addition to that, 3 students (BS9, BS11, BS14) responded that they preferred using verbal communication or instant messaging to communicating through the wiki.

As observed in Table 4, ENGL students consistently rated the knowledge management dimension (Q22-25) higher than the other two groups. This may be explained by the different goals of wiki as emphasized by the instructors. The primary goal of using wiki was mainly to facilitate online collaborative learning in the cases of BSIM and MECH. Whereas disseminating knowledge to the public is the primary goal emphasized by the ENGL lecturer (for a detailed discussion, please refer to section 4.2). Thus the high ratings given by ENGL students on the knowledge management dimension are coherent with the goal of wiki as emphasized by the lecturer.

3.2 Activity Patterns on Wikis

The wikis used by the ENGL students exhibited the most frequent use, while most of the MECH project wikis were found with low activity levels (See Table 5). An observable difference was found on the number of actions per student between the ENGL and MECH groups. A number of the MECH wikis showed low level of collaborative editing, and the core action observed was the "add" action (see Table 5, and Figure 2). A variety of actions were observed in wikis for the two other disciplines; BSIM students spent a considerable amount of effort on word level changes

(28.1%) while rewriting at sentence level was frequently observed in ENGL students (32.6% of "add" and 22.8% on "delete").

Despite the fact that students from different disciplines had different levels of participation in using the wiki, a general pattern has been observed by the classification of actions (see Table 5, and Figure 2). *Adding* sentences was the most prominent action performed by the students. As expected, the students tended to *add* instead of *deleting* and *moving* sentences. For within-sentence modifications, editing *words* was the prominent action by the students, followed by *formatting*. A low usage of *images* and *links* was observed from all groups.

Table 5: The actions performed by the students on the wikis

		Add	**Delete**	**Move**	**Format**
ENGL (n=15)	Count	590 (32.6%)	413 (22.8%)	61 (3.4%)	277 (15.3%)
	Per student	39.3	27.5	4.1	18.5
BSIM (n=22)	Count	466 (34.6%)	197 (14.8%)	40 (2.9%)	116 (8.7%)
	Per Student	21.2	9.0	1.8	5.3
MECH (n=34)	Count	62 (54.4%)	15 (13.2%)	3 (2.6%)	8 (7.0%)
	Per Student	1.8	0.4	0.1	0.2
		Grammar	**Words**	**Images**	**Links**
ENGL (n=15)	Count	44 (2.4%)	273 (15.1%)	73 (4.0%)	81 (4.5%)
	Per student	2.9	18.2	4.9	5.4
BSIM (n=22)	Count	118 (8.6%)	369 (28.1%)	5 (0.4%)	24 (1.8%)
	Per Student	5.4	16.8	0.2	1.1
MECH (n=34)	Count	3 (2.6%)	9 (7.9%)	9 (7.9%)	5 (4.4%)
	Per Student	0.1	0.3	0.3	0.1
		Total			
ENGL (n=15)	Count	1812			
	Per student	120.8			
BSIM (n=22)	Count	1335			
	Per Student	60.7			
MECH (n=34)	Count	114			
	Per Student	3.4			

Text posted through the "comment" function on wiki has been analyzed following the framework (see Table 2) in Chu, Lee, & King [4]. No comments were posted by the ENGL students despite their high action per student rate (See Table 6). As for the BSIM group, *content* was the most frequently observed type of comment, followed by *reply* and *group*. Only a few comments were made by the MECH students, with *group* as the most frequently observed type. No conclusive statement could be drawn on the use of comment among the three groups of students since the commenting function has not been used widely in two of the groups.

Table 6: The amount of comments made by students on the wikis

	Content	Form	Work	Individual
ENGL (n=15)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
BSIM (n=22)	84 (48.0%)	7 (4.0%)	16 (9.1%)	9 (5.1%)
MECH (n=34)	1 (12.5%)	0 (0.0%)	0 (0.0%)	1 (12.5%)
	Group	Reply	Total	Comments/ Student
ENGL (n=15)	0 (0.0%)	0 (0.0%)	0	0.0
BSIM (n=22)	20 (11.4%)	39 (22.3%)	175	7.95
MECH (n=34)	5 (62.5%)	1 (12.5%)	8	0.24

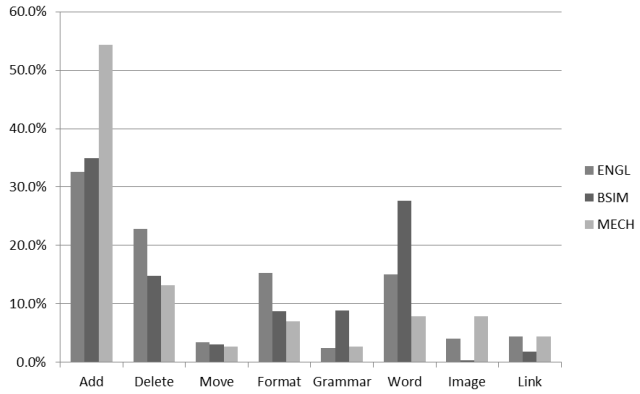

Figure 2. The proportion of actions on the wikis

4. DISCUSSION

4.1 Perception of Using Wiki for Collaborative Learning

Several focal observations can be found from the survey findings. Firstly, the ENGL students stated that they did not prefer the use of wiki in projects (See Q8 of the questionnaire) but the degree of participation of the ENGL students on the wiki platform was the highest among the 3 groups. Heavy workload brought on by the use of wiki might have a negative impact on students' intrinsic motivation. Students may regard the tool as a nuisance or an extra task. This is coherent with the interview responses that suggested wiki was "tedious", "redundant" and "a waste of time". If the student experienced technical difficulties which took much time to solve, the reluctance to use wiki might be even stronger. The relationship between technical difficulties faced and the student's motivation would be an interesting topic for further research.

The second major observation is the tendency of the BSIM students to score high in the survey items in general. Despite a number of opinions stating that communicating through the wiki tool is not efficient, the BSIM students were mainly positive on incorporating such a tool in their learning. A study [1] shows that people with more time spent on the Internet tended to demonstrate greater computer proficiency. Students and people working in technical fields also demonstrated better proficiency in computers (ibid.). As the BSIM students widely use computer tools to manage information, it is plausible that their acceptance and proficiency for similar tools would be higher.

The third major observation is that MECH students gave lower ratings in the *technology* factor than the ENGL and BSIM groups. As explained by the MECH lecturer, students needed to solve programming problems throughout the project, and the wiki was not very helpful in this particular aspect. Students often met face-to-face at the computer lab to debug a computer programme. Though a written report was required for all three courses, the weighting of such report for MECH was much lower, thus MECH students probably placed less emphasis on wiki's role in facilitating the co-construction of a written report.

4.2 Activity Patterns on Wikis

Students' activity patterns on wikis can be summarised in the following: (1) The number of actions performed *on* sentences was more than the actions performed *within* sentences (See Figure 1). (2) *Adding* was the most common action performed, and (3) students tend to *add* rather than *delete* and *move* sentences. (4) The BSIM group had more comments posted on the wiki than the ENGL and MECH groups. (5) A lower wiki usage was found in the MECH wikis. The first three findings were in agreement with previous studies on wiki-based collaborative writing [4, 12].

The differences in activity patterns among the three groups may be attributable to the different goals of the wiki viewed by the students. ENGL students regarded wiki as a tool for public presentation and web construction. Right from the beginning of the course, the ENGL lecturer made it clear to the students that the goal of using wiki in the project was to facilitate knowledge exchange to the public. Students were learning to become producers of knowledge rather than being mere consumers. The knowledge that students produced were meant for public sharing through Google Sites. The goal of collaborative learning via wiki is important, but only come secondary. As intra-group interaction was not the top priority, this may explain the low usage of the comment function on the wiki.

Though ENGL students did not use the commenting function in wiki, but comments and casual notes were embedded in the content of the wiki during the report co-construction phase. These comments usually required follow-up by the other group mates. Once an issue has been resolved, the comment was removed from the page. Instead of using the commenting function, this alternative approach may have contributed to a larger number of page modification actions, particularly the *delete* actions, as compared to the other groups. The actual number of "meaningful" page revisions on the ENGL wikis may be smaller. Nevertheless, this does not have a major impact on the fact that the ENGL students were active users of the wiki.

Possible differences on the wiki activity among students in the three disciplines may be attributable to the different scopes of the PBL. A written project report was the main deliverable for group projects in BSIM and ENGL; while the deliverables for MECH include a project report that supplements a piece of software programme. Therefore the written project report contributes to different score weightings among the three courses (60% for ENGL; 62.5% for BSIM; 20% for MECH). MECH students were primarily graded on their creativity and the design methodology of the solutions they proposed. The lower weighting of scores assigned to the written report may explain the low wiki activity among MECH students, as they may not have spent as much effort on the co-construction of the written report on the wiki platform. Also, the written report for MECH mainly serves as an instruction manual to the software programme, which may imply that MECH students spent less time on refining the language or revising its presentation format (hence majority of wiki activities observed were adding actions). Whereas rewritings or language polishing (as observed in the high proportion of delete actions, formatting changes, and word level changes) were frequent in students from ENGL or BSIM disciplines, which may be explained by the fact that students needed to demonstrate in the report their ability in applying theories in a specific context. Therefore students tended to spend a considerable amount of effort in presenting the ideas in the written report.

5. CONCLUSION

Results of the perceptual survey were not found to fully coincide with activities found on wikis. Though some students used the wiki actively, yet they did not show overwhelming support in using wiki in another course. For instance, both respondents EN1 and EN6 gave negative comments at the interview and low scores on the survey items related to the *Motivation* factor. Yet, they were the most active members in their groups in terms of wiki usage, with around 200 actions made on the wiki.

This study is not without limitations. Firstly, the representativeness of survey responses may be a question. Not all students in the course completed the survey, as it was a voluntary participation. The sample size was not large (the largest group only consisted of 22 subjects, while the smallest group only consisted of 8 subjects). Moreover, the MECH students did not take part in the interview session, which could provide more clues to their behaviours on the wiki. Secondly, the ENGL group was using a different wiki platform, which may have an effect on the results and on the comparisons followed. Thirdly, the coding of the wiki actions and comments were carried out by one researcher. Personal judgement and bias may affect the results of the coding.

While this study exclusively focuses on the students, it has now been clear that the major findings cannot be fully explained by only looking at the students. This may lead to a new emphasis of research: the teacher/instructor. Jonassen [9] and Oliver & Herrington [15] discuss the importance of making new instructional designs for incorporating Web-based tools in instruction. Oliver & McLoughlin [16] adds that there is a tendency for teachers to incorporate Web-based tools without proper restructuring the lesson design, underutilising the technology's potential. Future studies on wikis in instruction may involve analysis of the lesson design and the instructor's practice.

6. REFERENCES

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