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RESEARCH ARTICLE

Peer-feedback and revision process in a wiki mediated collaborative writing

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Abstract This study investigated the use of a wiki for collaborative writing among primary levels five (P5) and six (P6) students ($n = 119$) in a Chinese primary school in Hong Kong where English is taught as a second language (L2). Three classes of students and their English subject teachers participated in a three-month English language writing programme using a wiki. Quantitative and qualitative data were analyzed from activities recorded in the wiki system, including posted edits and comments, students' group writings and student and teacher interviews. The wiki page history revealed information on the types of revisions that occurred, showing that different types of feedback elicited actual revisions, which may have resulted in better group writing. Findings from the study may shed light on how wikis can help provide support for students' collaborative writing process with wikis, and how peer-feedback can influence this process.

Keywords Wikis · Collaborative writing · L2 writing · Primary school · Revision · Peer feedback

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Introduction

With the advancement of educational technology, there has been a strong emphasis on integrating Web 2.0 technologies into language teaching and learning (Education Bureau 2007; Richardson 2009). Web 2.0 tools have shown promise as platforms for facilitating collaborative language learning in general and writing in particular (Goodwin-Jones, 2003). New technologies have had a tremendous impact on the teaching and learning of writing in the last few decades (Goldberg et al. 2003; Hyland 2003). Among the suite of Web 2.0 technologies, wikis have been given special attention largely due to the success of large-scale wiki enterprises such as Wikipedia.

A number of studies have examined wikis with regard to their usage potential, effects on student learning, and effectiveness with appropriate instructional practices. However, most of these studies were conducted at the tertiary and secondary levels and covered a range of different subject disciplines, which include English language, geography, engineering, and library and information science (Chu 2008; Engstrom and Jewett 2005; Mak and Coniam 2008; Nicol et al. 2005). In Hong Kong, wikis have been found to be effective with local secondary level students in ESL writing (Mak and Coniam, 2008).

For younger learners, the writing task is more difficult because it requires "extensive self-regulation and intentional control to manage the writing environment, the constraints imposed by the writing topic, and the processes involved in composing" (Graham and Harris 2000, p. 3). Decades of research in developmental and educational psychology has shown that younger students face more difficulties in self-regulation, both in writing and in other school tasks, compared to older students (Bereiter and Scardamalia 1987; Graham and Harris 2000; Zimmerman and Martinez-Pons 1990). The use of wikis for writing tasks could help address the difficulties faced by younger learners. For instance, wikis have been shown to be a viable means of accessing a wide audience, which has been found to enhance the motivation of primary school students for writing (Lo and Hyland, 2007). However, whether wikis can be an effective learning platform for young learners at the primary school level remains relatively under-explored. Using wikis for collaborative writing requires cooperation among group members, consequently requiring a higher level of social competence needed for group management, which younger students may also find more difficult (Jones et al. 1998). In previous studies, the use of wikis for collaborative writing among secondary and tertiary students has been found to be useful (Chu et al., in press; Mak and Coniam 2008). Considering the developmental and psychological dimensions of younger learners, the question of whether wikis can be an effective platform for collaborative writing among primary school students has yet to be answered.

In this study, a mixed-methods approach was used to explore the potential benefits of peer commenting and editing on a wiki platform among students and teachers in three upper primary English language classes in Hong Kong. The findings contribute to our understanding of the use of wiki technology in collaborative writing, with specific application in second language (L2) teaching. Among the functions that are afforded by wikis, peer commenting, in particular, was examined and its contribution to the revision process during collaborative writing.

Literature review

A good deal of research has examined revision in student writing in English as both a first language (L1) (Faigley and Witte 1981; Fitzgerald and Markham 1987) and an L2 (Berg

1999; Min 2006; Paulus 1999; Tsui and Ng 2000; Yang et al. 2006). These studies have examined whether final text revisions involve content or form changes, and looked at how peer-feedback and teacher-feedback influence students' revision processes. Content changes involve global level changes in ideas, content and organization, while form changes consist of copy-editing operations including spelling, grammar, and punctuation (Faigley and Witte 1981). Although both content and form are important for quality writing, content changes tend to involve more sophisticated higher-order thinking skills, which leads to better quality written output (Bereiter and Scardamalia 1987).

The revision process of L2 writers

Most of the studies on the effects of peer feedback on the revision process in an L2 context have been conducted with tertiary and secondary school students. For example, a study involving English as a second language (ESL) students in an American university found that the majority of the writing revisions were surface-level changes, whereas the revisions resulting from peer and teacher feedback tended to be meaning-level changes (Paulus 1999). In contrast, Yang et al. (2006) found that among Chinese ESL university students in China, even teacher feedback resulted in surface-level changes. Teacher feedback did not lead to students' self-initiated revisions because the students perceived that corrections could only be accurate when provided by their teacher. On the other hand, students engaged in self-correction when they had doubts or reservations about peer feedback. Tsui and Ng (2000) found that secondary school L2 learners in Hong Kong favored teacher comments, which they incorporated into their writing, more than they did peer comments. Nevertheless, peer feedback enhanced a sense of audience, raised students' awareness of their own strengths and weaknesses, encouraged collaborative learning, and fostered ownership of text. Other studies (Berg 1999; Min 2006) have examined how trained peer responses, in contrast to non-trained peer responses, affect revision types and the quality of writing. In these studies, meaning-level revisions occurred at a higher rate when students were trained in giving peer responses. The studies suggest that to generate meaning-level revisions in L2 writing, teacher comments and trained peer feedback are critical components.

The revision process using technologies

Studies have examined the use of technologies in the writing revision process, mainly with adults and secondary students. For example, Liu and Sadler (2003) compared two groups of university students. One group was engaged in technology-enhanced group work using a text-based online virtual reality system with multiple users who are connected simultaneously (MOO) and Microsoft Word processing software with track changes. The other group consisted of students in traditional groups discussing face-to face during peer commenting and using pen and paper for revisions. The researchers found that the technology-enhanced group tended to generate a larger percentage of revision-oriented comments leading to a greater overall number of revisions than did the traditional group. In Liu and Sadler's study (2003), peer comments were categorized as global (i.e. related to content) or local (i.e. related to copy editing), the definitions of which correspond to meaning-level and surface-level revision respectively. Comments were also categorized as revision or non-revision oriented.

Collaborative writing with wikis

Many studies have shown that: (a) the accessibility, simplicity, openness and unstructured nature of wiki pages help learners to share information and resources among their teams, and make it easier for students to work at their own pace, as well as allowing them to see other groups' work (Coyle 2007; Guzdial et al. 2001; Honjegger 2005; Nicol et al. 2005); (b) students have positive perceptions about how these wikis can improve collaborative group work and the quality of their work (Chu 2008), (c) the effectiveness of wiki applications in learning and teaching depends on careful planning, and the training of both students and instructors to familiarize them with the technology and the optimal class size, as well as motivating students to learn from one another based on the discovery learning or project learning principles (Engstrom and Jewett 2005; Raman et al. 2005), and (d) there is a need for new ways to assess collaboration in a wiki learning environment (Barton & Heiman, 2012; Manion and Selfe 2012; Trentin 2009).

There are studies indicating positive results in the area of revision using wikis. Although Faigley and Witte (1981) have suggested that content revisions are more characteristic of expert writing than writing by inexperienced writers, Wikipedia articles examined by Jones (2008) found that articles written by inexperienced writers tended to contain more content revisions and fewer surface revisions. In another study, pre-service English teachers (non-native speakers, thus inexperienced) from a Mexican university who used a wiki collaborative writing platform were found to pay more attention to content revisions than to grammar revisions (Kessler 2009). A study of L2 writers using wikis in German language classes from three different North American universities found that the students used collaborative and cooperative strategies when making formal revisions but worked more cooperatively to make content changes (Arnold et al. 2012).

Studies using wikis for collaborative writing have made progress in the area of revision (Arnold et al. 2012; Jones 2008; Kessler 2009). However, this remains under-examined in terms of the text composition and revision of primary school children. Lo and Hyland (2007) found that Primary Five (P5) students in Hong Kong became more motivated to write when a wider audience was available. It is thus feasible that wikis could help scaffold students' writing through a platform of sharing, peer-commenting, and co-constructing (Richardson 2009, 2010). This study aimed to determine the extent to which young L2 learners can benefit from wiki technology in revising their writing effectively with teacher and peer feedback. To investigate the potential benefits of wiki technologies in primary school L2 collaborative writing, this study addressed current research gaps through the following research question: To what extent does a wiki, with its commenting and editing features, help upper primary school L2 writers during collaborative writing in an English language classroom? Four sub-questions helped to guide data collection:

1. What kinds of comments are posted?
2. What kinds of revisions are made on the wiki platform?
3. Is there an association between comments and revisions?
4. Is there an association between revisions and improvement in students' writing?

Methodology

This study was a mixed-methods multiple case study utilizing the strength of both quantitative and qualitative approaches (Creswell 2008) to investigate the role of a wiki in the

revision process of students' L2 collaborative writing. Specifically, the comments of teachers and students from three upper primary classes were examined to determine their relationship with students' writing performance.

Participants

The participants were from a Chinese primary school in Hong Kong, reputed to be of middle to high level in terms of students' ability to write in the English language. The school was an Anglican school with 50 % of primary six students going on to secondary schools where English is a medium of instruction. This meant that the upper primary school students would be capable of writing a minimum of 100 words in English. This was a requirement in the study in order to generate sufficient quantities of writing that could be examined for the purpose of the research objective. Two Primary 5 (P5) classes and two Primary Six (P6) classes were invited to engage in collaborative writing using wiki technology. Two P5 classes (referred to as 5X and 5Y in this article) and one P6 class (referred to as 6X) agreed to join the study. The 6X students had experienced using a wiki during the previous year in a pilot study (Authors, 2009, 2011). A total of 119 students, aged from ten to twelve years (mean age 11.6 years, 59 boys and 60 girls) returned signed informed consent forms from their parents. Three English subject teachers also volunteered and agreed to participate. They benefited from the participation by learning to integrate technology into their language classroom. The majority of the students were Chinese, and had been learning English as a second language for 5 to 6 years.

Intervention programme

The students and their teachers participated in an intervention programme during their English writing lessons for approximately three months. A wiki tool called PBworks (http://pbworks.com/education) was integrated into the students' collaborative writing lessons within their existing English language curriculum (HKCECES 2008). As a means to scaffold them in their writing, students were asked to co-construct their writing on PBworks pages created for each group, and exchange constructive feedback and comments through its platform guided by wiki rules that were provided by the teacher (please refer to Appendix 1 for details). Groups of four students were formed by their teachers, ensuring equitable distribution of members in terms of gender and academic ability. Each group was asked to produce two non-fiction texts: a biography of a famous person and a poster on students and school hygiene in the case of the P5 students, and an information report on earth pollution and a narrative involving a topic on looking for new flats in the case of the P6 students. Students were asked to illustrate their work with photos and graphics.

The lessons were planned for both face-to-face learning situations in the classroom or computer laboratory, and online learning outside their normal class hours. The progamme was refined based on the findings of a pilot study conducted with one P5 class which examined how wiki's key affordances might help in scaffolding students during their collaborative writing projects (Authors, 2009, 2011). The teachers further supported students' writing by providing a genre framework and timely feedback. A framework in the form of a writing prompt was provided online, as illustrated in Fig. 1 (creating a poster for hygiene). Teachers responded immediately, giving feedback to the students during the writing process rather than at the end when the product was finished. Skills such as

critically evaluating and extracting appropriate information from the Internet were also taught, and students were encouraged to paraphrase and summarize main ideas. For ethical reasons, the intervention program was offered to all four P5 and P6 classes, and those who volunteered to join formed the study participants. Consequently, there was no control group.

Data collection and analysis

Qualitative and quantitative data were collected and examined using multiple sources of evidence: (1) students' comments posted on the wiki platform, (2) editing information recorded in the wiki's history page, (3) evaluation of students' group writing and (4) student and teacher interviews conducted after the intervention programme. Since the students were also engaged in collaborative writing prior to the wiki intervention, two pieces of group writing that were completed without the wiki technology were also examined and served as comparison data to compensate for the lack of a control group.

To answer sub-questions (1) What kinds of comments are posted? and (3) Is there an association between comments and revisions, comments posted on the wiki platform were analyzed based on Liu and Sadler's (2003) categories, which have been used to examine the types of comments made through technology-enhanced peer discussion. Peer comments were divided into either of two overall categories: (1) Content Meaning or global, which referred to feedback that was related to idea development, audience, purpose, and organization of writing; and (2) Surface or local, which referred to comments that were related to copy-editing (e.g. wording, grammar, and punctuation). The comments were further classified into four types (Liu and Sadler, 2003):

1. Evaluations, which commented on features of writing;
2. Clarifications, which probed for explanations and justifications;
3. Suggestions, which pointed out the direction for changes; and.

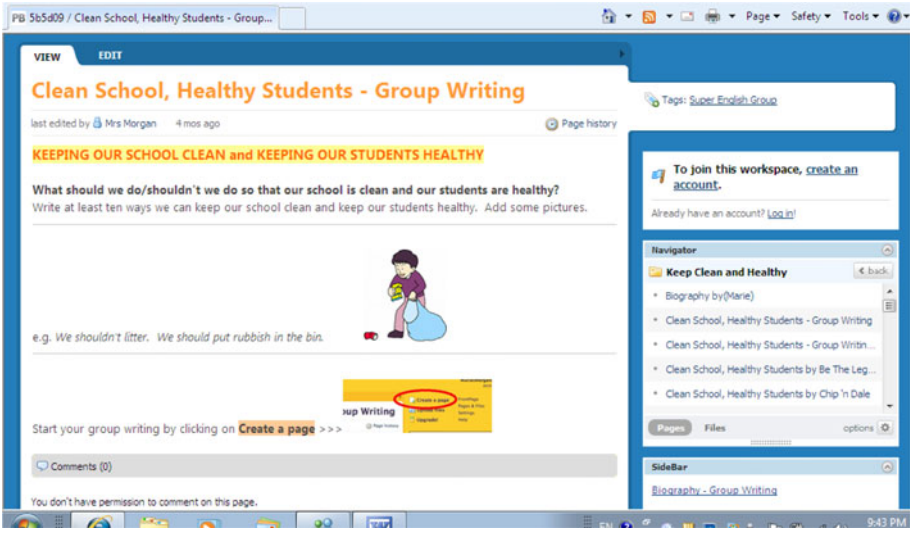

Fig. 1 A screen capture of primary five writing framework for topic on posters for hygiene

4. Alterations, which provided specific changes.

The comments were also categorized into revision-oriented comments, which were likely to lead to revision; and non-revision-oriented, which were not (Liu and Sadler 2003). Two other categories were added for this study: comments at the management level, which were aimed at managing group work or wiki technology, and any other comments that did not fit into the above categories, or were irrelevant to the writing topics as shown in Table 1.

In order to address sub-questions (2) What kinds of revisions are made on the wiki platform? and (3) Is there an association between comments and revisions, editing information generated by different groups, as recorded in the wiki's history page, was sorted by types of revision. An adapted version of Faigley and Witte's (1981) revision taxonomy was used in this study. This revision taxonomy was developed by comparing how inexperienced and expert writers revised their work, and has become widely used in writing revision analysis (Faigley and Witte 1981). It was also adapted for primary school students in North America in a study that investigated how direct instruction using the revision process affected writers' knowledge of revision and their efforts to revise (Fitzgerald and Markham 1987). Faigley and Witte's (1981) taxonomy has two broad categories: content or meaning changes, with subcategories of macrostructure and microstructure changes; and surface changes, with subcategories of meaning-preserving and formal changes. Meaning-preserving changes consist of changes such as additions, deletions, substitutions, rearrangements (permutations), expansions (distributions), and consolidations. Formal changes consist of changes in spelling, grammar, abbreviations, punctuation, and format. Macrostructure changes alter the overall direction and gist of the text. They affect the global meaning of the text and influence the summary and interpretation of the content. Microstructure changes are simple adjustments or elaborations of existing text and do not affect the overall interpretation of the text. They may involve the use of cohesive ties, causing sentence sequences to be understood as consistent and parallel connected discourse. Both macrostructure and microstructure changes are further categorized into the same subcategories of meaning-preserving changes: additions, deletions, substitutions, rearrangements (permutations), expansions (distributions), and consolidations (see Appendix 3 for rubrics). Revisions were measured as the number of occurrence in every 100 words in order to standardize the measure among various lengths of group writings. This method was also used by Bereiter and Scardamalia (1987, 1987).

To address the sub-question (4) Is there an association between revisions and improvement in students' writing?, students' group writings were evaluated using an analytic method adapted from Tompkins' (2004, 2010) scoring rubrics for assessing young writers, which has previously been used to assess the composition writing of P5 students in Hong Kong (Lo and Hyland 2007). Lo and Hyland justify their use of Tompkins' assessment sheet by saying that, although it was designed for L1 writers, it can be applied to young children's writing with the fundamental concept of process-oriented writing in mind. Group writing was analyzed according to three areas: (1) content and organization, which referred to the presentation of ideas, (2) language, which referred to use of grammar, correct spelling, imagery, vocabulary, etc., and (3) visual graphics, which consisted of the use of graphics, photos or pictures. The third area was added for our study since, as part of their writing instruction, the students were encouraged to draw graphics or pictures and for the wiki intervention to include graphics or photos from the Internet as part of their writing projects. Each major area was categorized into several sub-categories and each sub-category was given a score that ranged from 0 to 5 (excellent-5, good-4, average-3, below

Table 1 Types of comments. Adapted form Liu and Sadler (2003)

Level	Content Meaning (Global) level: comments aimed at global aspects of writing: development, audience and purpose, and organization of writing		Surface (local) level: comments aimed at local aspects of writing: copy editing, rewording, grammar and punctuation		Management level: comments that are related to management of or operating wiki technology	Other comments: any other comments that are unrelated to writing and do not fit into the above categories
Nature	Revision oriented: will likely lead to revision	Non-revision oriented: will not likely lead to revision	Revision oriented: will likely lead to revision	Non-revision oriented: will not likely lead to revision	Non-revision oriented: will not likely lead to revision	
Type	Examples					
Evaluation: comments on either good or bad features of the writing	Your beginning isn't very interesting, is it?	Good job!	The grammar is good but it's too formal	The last sentence is good, prefect	Save it quickly!/ Finish your edit, Joshua. I am going to write	Thank you !! Other playful communication unrelated to the task
Clarification: probes for explanations and justifications	Why the first line, give birth to a baby daughter and the mum said baby sister or brother?	Very good. Clear and easy to understand. Other confirming remarks	What is "iug" foods?	Is it (picture) better? Other confirming remarks	Rachel is going to check grammar	
Suggestion: point out the direction for change	Well done but you can say something about her family/Or add more information or ideas	Your biography is good, keep doing this	You can add more words. You can put more picture in it	You have to change/be careful with the mistakes. You have pictures. Continue working hard		
Alteration: provide specific changes	You can write more interesting things about her, like when did she start windsurfing. Any new idea contributions		You can change 'a gold medals' to 'gold medals'	You should change 'traveler' to 'traveller'. (But 'traveler' is correct)		

average-2, poor-1, components not used-0). There was a total of 13 sub-categories in the three areas, with the highest possible score being 65 (refer to Appendix 2 for details and an example of how one researcher graded the group writing). To reflect the genre aspects of

the students' writing, two sub-categories were added to the list: sub-category 7 in Organization: 'Appropriate use of genre and its conventions', and sub-category 5 in Language: 'Use of imagery, simile or metaphor'.

Qualitative data from transcribed students and teacher interviews were used to support some of the quantitative data findings. Students and teachers were asked to read and confirm the accuracy of the interview transcriptions.

To assure the inter-rater reliability of the coding methods, two independent raters examined 25 % of the data from peer comments, revisions, and group writing evaluation. Such a procedure has been carried out in other studies that involved student responses (Purdie et al. 1996), revision analysis (Paulus 1999), blog comments (Sun 2006), and peer responses (Berg 1999) study. High inter-rater agreement was found for analytical grand total score, content and organization, language and visual graphics and photos (89–97 %, significance of correlation between the two raters being $p < 0.001$). Excellent inter-rater agreement was found for the main items of comments analysis, content and meaning level, surface level and management and other non-related comments (96–99 %, significant at $p < 0.001$), and for the main items of revision analysis, content and meaning changes, surface changes and total overall revision (91–96 %, significant at $p < 0.001$).

Quantitative data were analyzed using SPSS (Window version 17.0) to examine the correlations between comments and revisions, and a paired samples t test to determine significant differences between wiki and non-wiki group writing scores. The data were checked for normality, linearity and homodescacity, and none of the major assumptions were violated. Qualitative data was further examined to support or illustrate the quantitative findings.

Findings and discussion

Types of comments posted on the wiki platform

To address the sub-question (1) What kinds of comments are posted?, the comments were coded by type for each of the three participating classes. Comments were coded as: (1) content/meaning-related, (2) surface level, and (3) management-related/others.

Content vs. surface level comments

Across the three classes, content/meaning level comments were dominant, except for Class 5X, comprising 50.43–35.14 % of the comments, as shown in Fig. 2. Surface level comments comprised 24.45–56.96 % of the comments, while the remaining 7.9–18.68 % pertained to management-related and other unclassified comments.

As shown in Fig. 2, content/meaning level comments were predominant in the comments of both Class 5Y ($M = 43.29$, $SD = 22.73$) and Class 6X ($M = 50.43$, $SD = 17.06$); only in Class 5X was there a higher proportion of surface level comments ($M = 56.96$, $SD = 20.05$). These findings are generally in line with Liu and Sandler's {2003 #11} study with university students, in which technology-enhanced group work tended to produce a higher percentage of content meaning level comments than surface level comments when compared to traditional face to face discussion groups.

As shown in Table 3, the results were recorded by topics and classes in percentages of occurrence out of total comments, but the total categorized comments and posted comments were shown according to the frequency of occurrence. The total number of actual

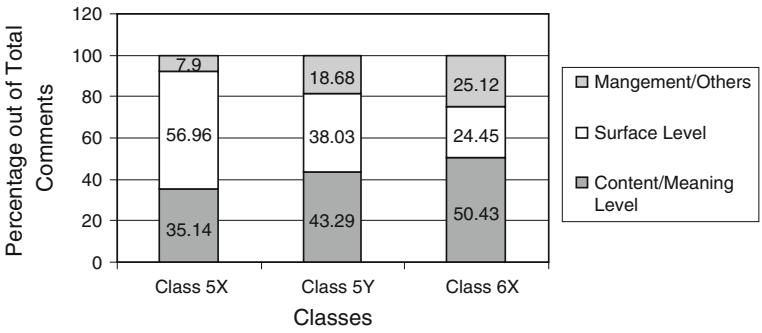

Fig. 2 Percentage of comments by Type and Class. *Note* The different *shaded* and *non-shaded areas* refer to the different types of comments

comments was less than the sum of comments coded in the categories, because one comment may actually be classified under more than one category. For example, "Good! The picture is beautiful. But you can add more word to say your feeling!" was categorized as both surface non-revision-oriented and content and meaning revision-oriented. For this reason, statistical analysis using SPSS to test for significant differences was not used. However, a graphic illustration and qualitative data such as excerpts from the wiki platform and quotes from students and teacher interviews are presented to further support this part of the findings.

Revision vs. non-revision oriented comments

Table 2 shows a summary of revision and non-revision oriented comments at the content meaning and surface levels. There were more overall revision oriented comments than overall non-revision oriented comments, as shown in the upper part of Table 2, except in the case of Class 5X, which had slightly more non-revision oriented comments. A more in-depth analysis comparing the revision versus non-revision oriented comments for each subcategory (content/meaning level and surface level) is shown in the lower part of Table 2. Although for Class 5X, there was a greater number of non-revision oriented comments than revision oriented comments at the content meaning level, there was a much higher number of revision-oriented comments than non-revision oriented comments at the surface level. A higher percentage of revision oriented comments than non-revision oriented comments were observed at both the content and meaning level and the surface level for Class 5Y, and with even a larger percentage for Class 6X. This may be due to PBworks' functions in providing writers with spell checks to reduce their cognitive loads (MacArthur 2009), and the Internet allowing a host of ideas and information to be made available, enabling writers to focus on the content by extracting main points for their own writing. Sample quotes from teacher and student interviews may illustrate these points:

- I enjoy using the wiki because if we don't know some words we can use the online dictionary so (that?) we don't need to use so much time to find them using the dictionary. (student 36).
- …. I do think there is an improvement in the amount of content included in the wiki writing. I believe this is due to being able to search for information on the Internet while working on the wiki. (coordinator).

Table 2 Revision oriented vs. non-revision oriented comments for content level and surface level comments

Class				
$N = 20$	Revision oriented		Non-revision oriented	
	Mean	SD	Mean	SD
Overall revision oriented vs non revision oriented				
5X	45.30	24.73	46.79	22.43
5Y	50.57	26.49	30.75	18.00
6X	67.13	18.04	7.74	6.06
Content meaning level				
5X	8.82	11.80	26.32	15.68
5Y	25.58	19.77	18.7	16.63
6X	44.35	16.33	6.08	4.86
Surface Level				
5X	36.49	24.72	20.47	15.11
5Y	25.98	20.35	12.05	15.76
6X	22.78	18.12	1.67	2.92

Note: Recorded in percentage out of total categorized comments. SD = standard deviation

- …. they are willing to write more because they get more information from the Internet. They can get easier access to other peoples' work so that it helps stimulate ideas for their own work. (6X teacher).

To understand these findings and the discrepancies, the data were further analyzed by topics and are summarized in Table 3. For Class 5X and Class 5Y, there were many more comments posted during the second topic. Class 5Y posted more content and meaning level comments than surface level comments, except for the first topic, where the difference between the two levels of comments was very slight. There seemed to be more revision-oriented comments at both the surface level and the content and meaning level. In contrast, Class 5X produced more surface level comments than content and meaning level comments for both topics. There tended to be more revision-oriented comments at the surface level, while non-revision-oriented comments tended to be dominant at the content and meaning level. These discrepancies may have been due to a combination of teaching style differences, student's writing abilities and maturity in social skills.

Although both classes posted substantially more comments during the second topic than during the first topic, the relative proportions of comments for each category were rather consistent between the two topics, except for management and other non related comments, which increased during the second topic. This may have been due to the different genres of the topics. The second topic required students to write a poster on how to keep healthy, and thus involved more instructional management and formatting than the first topic. The increase in management and other non-related comments may also have been due to students becoming familiar with the communicative function of wiki's platform, as shown by the excerpts in Table 4. The excerpts shows how Class 5Y students posted playful comments as they realized the benefits of the open forum and communication between their peers. All the italics in the excerpts indicate the commenter, group name, time, and date. One can see how the students were excited about being able to communicate online with other group members. This is similar to a study in which students felt

Table 3 Types of categorized comments by topics

Types of comments	Percentage out of Total Categorized Comments % (SD)					
	5X		5Y		6X	
	Topic I $N = 10$	Topic II $N = 10$	Topic I $N = 10$	Topic II $N = 10$	Topic I $N = 10$	Topic II $N = 10$
Content/ meaning level overall	37.99 (18.61)	32.29 (15.68)	45.5 (23.74)	41.12 (22.72)	57.39 (11.83)	43.46 (19.15)
Revision oriented	13.87 (14.26)	3.77 (5.85)	31 (22.88)	18.2 (14.52)	49.31 (10.56)	39.39 (19.92)
Non-revision oriented	24.12 (16.42)	28.52 (15.46)	14.49 (18.21)	22.92 (14.58)	8.08 (4.79)	4.07 (4.25)
Surface level overall	59.96 (18.85)	53.96 (21.76)	46.76 (28.84)	29.31 (24.49)	17.30 (11.67)	31.6 (21.85)
Revision oriented	38.29 (21.98)	34.68 (28.28)	34.36 (18.78)	17.61 (19.12)	15.31 (9.16)	30.25 (22.03)
Non-revision oriented	21.67 (13.42)	19.28 (17.29)	12.4 (16.08)	11.7 (16.29)	1.99 (3.10)	1.35 (2.87)
Management/ other non related comments	2.05 (4.73)	13.75 (15.41)	7.79 (15.62)	29.58 (22.04)	25.31 (16.39)	24.94 (17.18)
Frequency of occurrence						
Total categorized comments	118	183	100	182	766	283
Posted comments	90	154	77	172	714	273

Content/Meaning Level Overall % + Surface Level Overall % + Management/Other non related Comments % = Total Categorized Comments (100 %)

more comfortable communicating online compared to a face to face situation (Jones et al. 2006).

In contrast to those of Class 5X and Class 5Y, Table 3, the comments of Class 6X's decreased during the second topic, and this may have been due to the difference in genre. The first topic, being general description involving an Internet search to collect information, needed brainstorming ideas on the part of students, whereas the second topic, being narrative with a story framework provided, involved less discussion. For Class 6X, there seemed to be more content and meaning level comments than surface level comments, especially in the first topic, where the difference between the two levels of comments was distinct. There seemed to be more revision oriented comments at both the surface level and the content and meaning level, which shows that the Class 6X students were engaging in quite meaningful peer feedback that was revision-oriented. Although there were quite a number of differences in the number of comments posted during the second topic, again, the relative proportions of comments for each category remained rather consistent between the two topics.

Although Class 6X students made more management and other non-related comments than 5X and 5Y students, they were more on task and more engaged in brainstorming ideas, as shown in an excerpt from Class 6X's posted comments in Table 5. This is not

Table 4 Excerpts of posted comments from 5Y

Posted comments (5YIIGMarie)	Types of comments
Vincent (Marie)/11:26 am/Feb 1, 2010	
Vinci, can u see me?	Other non related
Vinci (Marie)/11:27 am/Feb 1, 2010	
Yes, ok	Other non related
Vinci (Marie)/11:27 am/Feb 1, 2010	
HI I am Apri. l	Other non related
Vincent (Marie)/11:28 am/Feb 1, 2010	
Vinci!	Other non related
Vincent (Marie)/11:30 am/Feb 1, 2010	
We should consentrate on our work!Do not play toooooooooooooohappy!!!!!!!!!!!!!!!!!!!!!!!!!!!!	Management
Jeffrey (Little Monster)/11:31 am/Feb 1, 2010	
GOOD!!!!!!!!!!HARDWORKING!!!!!!!!	Content non-revision oriented-evaluation
Vincent (Marie)/11:31 am/Feb 1, 2010	
VINCI VINCI VINCI VINCI VINCI VINCI!	Other non related

surprising since Class the 6X students were expected to be more mature in their social skills and their writing skills than primary five students. Another reason may lie in the fact that the Class 6X students had experienced using a wiki during the previous year in a pilot study (Author; 2009, 2011), and it was noted that they had sustained their engagement with the technology even after the effect of novelty (Hawthorn effect) had worn off. This group of students exchanged their ideas through comments before they actually started to write on the wiki platform.

Types of revisions posted on the wiki platform

To answer the sub-question (2) What kinds of revisions are made on the wiki platform?, the results were recorded according to the number of revisions per 100 words, except for the number of posted edits and comments, which are shown according to frequency of occurrence in Table 8. Figure 3 shows that in all three classes, more than half of the total categorized revisions per 100 words that each class made were generally content and meaning changes in nature, which is a good indication that meaningful editing was taking place at the content level rather than mainly at the surface level. Previous studies that have used wikis in secondary and tertiary levels have shown similar patterns (Kessler 2009; Mak and Coniam 2008). The findings of this current study indicate that such a beneficial effect of a wiki on revision occurs even among younger students.

According to Faigley and Witte (1981), macrostructure change is a major change that alters the summary of a text, while microstructure change does not affect the overall summary, gist, or direction of the text. For example, Table 6 shows that inserting, "Do you know why do the sea are so dirty? It is because…" in line three of the posted edits is a macrostructure change. This is because the whole tone of the voice changes into one that

Table 5 Excerpts of posted comments from 6X

Posted comments (6XIDMCR&B)	Types of comments
Charis Ann (MC in R&B)/12:15 pm/Jan 20, 2010	
So… what's the topic	Management
Mandy (MC in R&B)/12:16 pm/Jan 20, 2010	
?	Other non related
Charis Ann (MC in R&B)/12:16 pm/Jan 20, 2010	
I need topic so i can write	Management
Rachel (MC in R&B)/12:16 pm/Jan 20, 2010	
I don't think it's a gd idea to write air pollution because our class writing is air pollution	Content non-revision oriented-evaluation
Bessie (MC in R&B)/12:16 pm/Jan 20, 2010	
No, i don"t agree!! We can"t write a lot if we write land pollution!!	Content non-revision oriented-evaluation
Charis Ann (MC in R&B)/12:16 pm/Jan 20, 2010	
Plz topic	Management
Rachel (MC in R&B)/12:17 pm/Jan 20, 2010	
I don't think it's a gd idea to write air pollution because our class writing is air pollution already	Content non-revision oriented-evaluation
Bessie (MC in R&B)/12:17 pm/Jan 20, 2010	
But I think there will be a lot of groups will write ap	Content non-revision oriented-evaluation
Charis Ann (MC in R&B)/12:17 pm/Jan 20, 2010	
TOPIC!!!!!!!!!!!!	Management

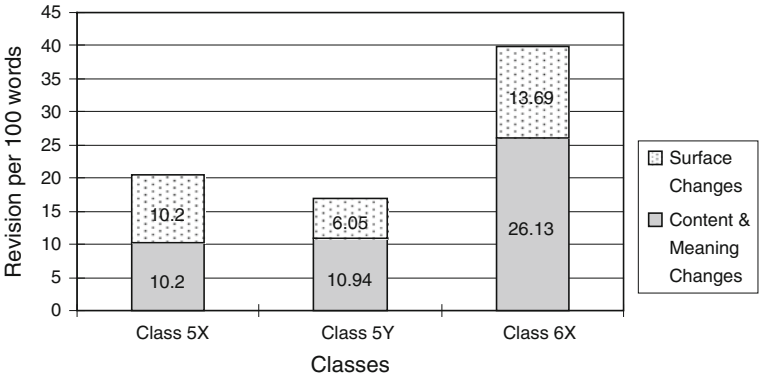

Fig. 3 Types of Revision per 100 words by Class. *Note* The different shaded and non-shaded areas refer to the different types of comments

questions the audience, instead of a straightforward declarative statement about how living things can get hurt from the dirty water. Inserting, "If we don't do anything, those problem will happen:" at the end of the passage is a microstructure change. In this case, the revision rephrases the words, but the main point of how the rise in temperature will cause damage remains the same.

Table 6 Experts of posted comments and edits from 6X

Posted comments (6XIALittleWriters)	Types of comments
Miss Lee said at 12:21 pm on Jan 21	
I love the slogan and the content. However, you should expand the ideas with the target structures so that they can be presented in paragraphs.	Content revision oriented evaluation Surface revision suggestion
Zoe (The Little Writers) saidat 7:40 pm on Jan 21, 2010	
thank you miss lee!!!!!!!!	Management & other non related comments
Tiffany (The Little Writers)/12:26 pm/Jan 21, 2010	
Water pollution Sometimes, you will see much rubbish in the sea .Why?? Because of us. We shouldn't throw rubbish in the sea. In order to decrease discharge oil in the sea, we need to take fever ship, boat or ferry...And we shouldn't take land from the sea because the animals will not have enough places to live.	Content revision oriented alteration
Posted edits (6XIALittleWriters)	Types of revisions (frequency)
Thu Jan 21, 2010 (12:30:54pm) to Thu Jan 21, 2010 (7:28:32pm)	
Boating Solution: Do you know why do the sea are so dirty? It is because people throw rubbish into the sea. It hurts the animals very seriously. When the we drink the dirty water, we will get sick. In order to decrease discharge oil in the sea, we need to take fewer ship, boat or ferry, etc. Except those ways, we shouldn't take land from sea because the animals will not have enough places to live.	Macrostructure substitution (2) Macrostructure addition (4) Microstructure substitution
Air Pollution Causes: Too many people smoke People use a lot of paper Stop pollution and results: Air pollution is getting serious, ... If we don't do anything, those problem will happen: The temperature will rise because of global warming, the fumes of cars cause acid rain and it damages not only plants and animals, but also ourselves, etc. For a better life, come and proptect the environment ! Pass themassageabove to your family! Designer:T.L.W. GovernmentReaders: Primary students	Macrostructure deletion Microstructure addition Microstructure consolidation

Deleted: Throw garbage away from

Deleted: .
Take public trasport instead of ferry .
Results: .
Animals become lifeless. .
Sea water willbecome dirty. If

Deleted: water,they

Deleted: .
The ocean

Deleted: turn as black as night.

Deleted: pollution:

Deleted: Results: .
The tempature

Deleted: warming. .
The

Deleted: rain. .
Acid

Deleted: can damage

Deleted: ourselves

The breakdown of content meaning level and surface level categories into sub categories is summarized in Table 7. There were more content meaning level changes at the macrostructure level than there were at the microstructure level for all three classes. On the other hand, the surface level changes consisted of more formal changes than meaning-preserving changes for all three classes.

Table 8 shows the details of the categorized revisions by topics. It shows that for all topics except for Class 5X's second topic, close to half of the revisions and more than half in the case of Class 6X were content and meaning changes rather than surface changes. Similar to posted comments, the number of edits posted depended on the type of genre. For example, the second topic for Class 5X and Class 5Y was writing a poster, which required

Table 7 Macro vs. micro changes at content and meaning level and meaning preserving vs. formal changes at surface level revisions

Class	Content meaning level revision			
N = 20	Macro changes		Micro changes	
	Mean	SD	Mean	SD
5X	8.11	5.44	2.09	2.10
5Y	8.83	13.00	2.11	1.80
6X	17.72	10.89	8.41	5.66
	Surface level revision			
	Meaning preserving changes		Formal changes	
	Mean	SD	Mean	SD
5X	1.20	1.65	9.00	8.12
5Y	1.4	2.25	4.65	4.94
6X	2.48	2.42	11.21	6.54

Note: Recorded in number of revision per 100 words. SD = standard deviation

Table 8 Types of categorized revisions by topics

Types of revisions per 100 words (SD)						
Types of revisions	5X		5Y		6X	
	Topic I $N = 10$	Topic II $N = 10$	Topic I $N = 10$	Topic II $N = 10$	Topic I $N = 10$	Topic II $N = 10$
Content/meaning changes overall	9.18 (6.08)	11.22 (4.94)	6.02 (4.80)	15.86 (18.30)	31.54 (14.16)	20.72 (10.05)
Macrostructure	7.85 (5.56)	8.36 (1.77)	4.72 (3.82)	12.94 (5.52)	23.19 (12.47)	12.25 (5.35)
Microstructure	1.32 (1.44)	2.86 (2.42)	1.30 (1.26)	2.92 (1.95)	8.35 (5.69)	8.47 (5.94)
Surface changes overall	7.8 (7.76)	12.55 (9.52)	3.92 (4.38)	8.18 (7.97)	15.24 (6.86)	12.15 (8.43)
Meaning preserving	1.44 (1.99)	0.96 (1.29)	0.80 (0.97)	2.0 (92.99)	2.29 (2.07)	2.67 (2.83)
Formal	6.42 (5.95)	11.58 (9.44)	3.12 (3.48)	6.18 (5.86)	12.94 (6.08)	9.48 (6.82)
Total categorized revisions	17. 04 (12.75)	23.77 (9.52)	9.94 (2.72)	24.04 (23.28)	46.78 (19.26)	32.87 (14.49)
Frequency of Occurrence						
Posted edits	108	98	83	104	314	327
Posted comments	90	154	77	172	714	273

Content/Meaning Changes Overall per 100 words + Surface Changes Overall per 100 words = Total Categorized Revisions per 100 words

* Significant at $p < 0.05$ and ** significant at $p < 0.001$

less editing than their first topic, but needed more discussion on formatting and presentation, while Class 6X's first topic involved a narrative with a story framework provided, and thus involved less discussion.

Association between comments and revisions

To address the sub question (4) Is there an association between revisions and improvement in students' writing?, Pearson correlation between comments posted and revisions made were analyzed as shown in Table 9. For all 5X, 5Y and 6X classes, there were significant and moderate positive correlations between the number of comments posted and the total categorized revisions per 100 words, indicating that the more the students posted comments, the more different types of revisions were recorded per 100 words (5X: $r = 0.449$ 5Y: $r = 0.459$, 6X: $r = 0.561$ $p < 0.05$).

The excerpts from Class 6X's data in Table 6 may to help illuminate the sub-question (3) Is there an association between comments and revisions? They shed light on how the content and meaning level revision-oriented comments shown under Types of comments seem to elicit the content and meaning level changes shown under Types of revisions. Ms Lee's evaluative comments on the content (content revision oriented) and suggestion concerning use of structures and paragraphs (surface revision oriented), together with Tiffany's comments providing alternative idea changes (content revision oriented), lead to macrostructure and microstructure changes shown under Posted edits.

The asynchronous (not real time) nature of the online platform may provide easy access and feedback anywhere, anytime beyond the actual classroom, which may stimulate and elicit more revision. A teacher commented: "Wiki is a more efficient platform for them to comment on each other's work during and after the writing process. They found it convenient…." and added, "Students in most groups can respond to my suggestions immediately. Therefore it facilitates the editing efficiency." Students also commented during their interview: "It is useful because we can use the wiki when we are not at school. We can also do it at home", "We can do this at home so we can have more time to do it" and "…because we can do it whenever there is a computer".

For all three classes, there was a positive correlation between the number of comments posted and all types of categorized revisions, except for Class 5X macrostructure changes, where there was a slight negative, but not significant, correlation. For Class 6X, the revisions that had a significant correlation with posted comments were microstructure changes ($r = 0.463$), surface changes ($r = 0.663$), under formal changes ($r = 0.678$) $p < 0.05$. Both 5X and 5Y varied with significance shown in surface changes ($r = 0.552$) under formal changes ($r = 0.589$) for 5X and under meaning-preserving changes ($r = 0.520$) for 5Y $p < 0.05$. The most common revisions were formal changes involving spelling, punctuation, grammar, which was also reported by another study conducted in Hong Kong (Mak and Coniam 2008) with L2 secondary students using wiki technology.

Table 10 shows an excerpt from Class 6X's posted comments and edits, revealing how both content revision-oriented and surface revision-oriented comments seemed to bring about surface and formal level changes. Stephanie's surface revision oriented comments result in "live" and "wants" being changed to "lived" and "wanted" respectively from the first edit. Ivy's first content revision oriented comment stimulates a change from "villa is the only flat which fits me!" to "villa is the only house which is my favourite!", and her second content revision oriented comment results in microstructure and formal spelling changes as shown in the second edit "the onlytype of house which is my favourite!". Janice's surface revision oriented comments on "and" results in the third edit deletion of "and". Janice's second surface revision oriented comment ends in formal grammar changes of "delighted".

Table 9 Pearson Correlation Coefficient between number of posted comments and types of revisions by class

Pearson correlation coefficient between number of posted comments and types of revisions by Class (p value)								
Types of revisions	Class	Content/Meaning changes overall	Macrostructure	Microstructure	Surface changes overall	Meaning preserving	Formal	Total categorized revisions
Posted comments	5X	0.054 (0.820)	−0.08 (0.737)	0.350 (0.130)	0.552 (0.012)*	0.044 (0.855)	589 (0.006)*	0.449 (0.047)*
	5Y	0.425 (0.062)	0.419 (0.066)	0.267 (0.255)	0.388 (0.091)	0.520 (0.019)*	0.284 (0.255)	0.459 (0.042)*
	6X	0.384 (0.095)	0.225 (0.344)	0.463 (0.040)*	0.663 (0.001)*	0.267 (0.256)	0.678 (0.001)*	0.561 (0.010)*

Figures with * indicate significance at $p < 0.05$

Table 10 Experts of posted comments and edits from 6X

Posted Comments (6XIISJIJ)	Types of comments
Ivy (SJIJ)/2:41 pm/Feb 2, 2010 "Dad,I want to move to a new flat!!!Ummm...villa is the only flat which fit me!' said Ashley."This sentence is strange.	Content revision oriented-evaluation
Stephanie (SJIJ)/2:42 pm/Feb 2, 2010 live---lived wants--wanted	Surface revision oriented-alteration
Ivy (SJIJ)/2:42 pm/Feb 2, 2010 I think we can change it into "villa is the only type of house which is my favourite!"	Content revision oriented-alteration
Janice (SJIJ)/2:48 pm/Feb 2, 2010 And at that moment,Ashley's brother came back with mum. I think that "and" is innecessary	Surface revision oriented-alteration
Janice (SJIJ)/2:51 pm/Feb 2, 2010 Don't you feel delight?!'said Ashley. It should be "delighted"!!	Surface revision oriented-alteration
Posted Edits (6XIISJIJ)	**Types of revisions**
from Tue Feb 2, 2010 (2:40:37pm) to Tue Feb 2, 2010 (2:42:56pm) Her father could not sayanother word. 'Dad?!Are you OK?'asked Ashley. And at that moment,Ashley's brother cameback with mum. 'What are youdiscussing?'	Macrostructure- additions
Tue Feb 2, 2010 (2:42:56pm) to Tue Feb 2, 2010 (2:44:09pm) Moving To ANew Flat parents lived in Causeway Bay. One day,when Ashley came home from school,she told her father that she wants to move to a new flat. 'Dad,Iwant to move to a new flat!!!Ummm...villa is the onlyhouse which is my favour!' said Ashley. 'Move?why?Is the building going to be rebuilt?'Ashley's father was surpised. 'Definitely not!'replied Ashley.	Formal grammar Microstructure substitution **Deleted:** live **Deleted:** only flat **Deleted:** fit me!'
Tue Feb 2, 2010 (2:44:09pm) to Tue Feb 2, 2010 (2:45:14pm) Moving To ANew Flat Ashley and her parents lived in Causeway Bay. ..... the onlytype of house which is my favourite!' said Ashley. 'Move?why?Is the building going to be rebuilt?'Ashley's father was surpised. 'Definitely not!'replied Ashley.	Microstructure additions Formal spelling **Deleted:** onlyhouse **Deleted:** favour!'
from Tue Feb 2, 2010 (2:49:22pm) to Tue Feb 2, 2010 (2:55:36pm) 'No reason.I just want to move.'said Ashley. Her father could not sayanother word. Ashley,At that moment,Ashley's brother,Mika cameback with mum. 'What are youdiscussing?Sounds interesting!'said Mika. feel delighted?!'said Ashley. 'Wow!Manificent!How big is it?I feel so excited!'said Mika.	Microstructure- deletions Formal- grammar **Deleted:** And at **Deleted:** delight?!'said

Some quotes from student questionnaires may also illustrate this point: "I improved the grammar skills because a friend told me in the wiki" and: "I have learned the spelling, tense of words because of my classmates comments".

Table 11 shows how Pearson correlations between subscales of both categorized comments and revisions were analyzed to determine if any association existed between the types of comments posted and the revisions made. In the case of Class 5X, there was a negative correlation between non-revision-oriented surface level comments and content and meaning changes at the macrostructure level, which was significant ($r = -0.455$ & $r = -0.520$, $p < 0.05$). This indicates that the fewer the non-revision-oriented surface level comments, the more the content and meaning revision changes at the macrostructure level. However, an unexpected phenomenon occurred in the case of 6X, in that there was a significant correlation between non-revision-oriented surface level comments and content and meaning changes at the macrostructure level ($r = 0.501$ & $r = 0.541$, $p < 0.05$).

Table 11 Pearson Correlation Coefficient between comments and revisions by class

Categorized comments/revisions	Pearson correlation coefficient between categorized comments and revisions by Class (p value)						
	Class	Content/Meaning changes overall	Macrostructure	Microstructure	Surface changes overall	Meaning preserving	Formal
Surface level: non-revision oriented	5X	−0.455 (0.044)*	−0.520 (0.019)*		−0.012 (0.959)		−0.003 (0.991)
	5Y	−0.271 (0.248)	−0.253 (0.288)		−0.067 (0.978)		0.074 (0.756)
	6X	0.501 (0.024)*	0.541 (0.021)*		0.616 (0.004)*		0.576 (0.008)*
Management/other non related comments	5X			0.475 (0.034)*		0.242 (0.304)	
	5Y			0.664 (0.001)*		0.372 (0.106)	
	6X			0.145 (0.542)		0.602 (0.005)*	

Figures with * indicate significance at $p < 0.05$

Table 12 Experts of posted comments and edits from 6X

Posted comments (6XIIFCSuperfantasticfour)	Types of comments	
Miss Lee/10:50 am/Jan 21, 2010		
good research! I like the pictures, but you have to cite the sources	Surface non revision oriented-evaluation	
of the pics as well.	Surface revision oriented-alteration	
Posted edits (6XIIFCSuperfantasticfour)	**Types of revision (frequency)**	
Thu Jan 21, 2010 (10:43:41pm) to Thu Jan 21, 2010 (10:55:28pm)		
Our Dirty Earth		
Super Fantastic Four are going to design a poster for all secondary schools students in Hong Kong.		
Every day WATER POLLUTION are harming not only us, but also the Earth.We should help our Earth and ourselves!In order to protect theenvironment, we need to do something now.	Formal punctuation Microstructure addition-4 Microstructure substitution-2	**Deleted:** Day **Deleted:** us And **Deleted:** Earth...We need to protect
CleanWater,Sea Better!!!		**Deleted:** ourselves!Let's think about what
Water Pollution in Hong Kong		
Causes:	Formal grammar-2	**Deleted:** can
produce both sewage and chemical. They are discharged to the rivers and will pollute the water.		**Deleted:** for the environment!!
...		
3. People throwrubbish to the rivers. They pollute the water. for building more and more.		**Deleted:** building.
Solutions:		
andsewage into the rivers.		**Deleted:** in
Problems:		
1. There are a lot of germs in the polluted water. If people drink this water,it will cause different kinds of illnesses.	Meaning preserving substitution Microstructure deletion	
be less and less.		**Deleted:** endangered.
3. We can't swim in the sea anymore because the water is dirty. If we swim in the polluted water, we will hurt our skin.		**Deleted:** dirty and
(http://www.airheadsscuba.com/kayesite1/wtrpoll.html)		
(http://www.flickr.com/photos/marelles/2215563719/)		
Thu Jan 21, 2010 (10:55:28pm) to Thu Jan 21, 2010 (11:00:03pm)		
Water Pollution in Hong Kong		
Causes:		
the water.Therewill be a lot of germs in the polluted water. If people drink this water,it will cause different kinds of illnesses.	Macrostructure rearrangement-4	
2. Tankers sometimes have accidents. At that time, plenty of oil leaks out of the tankers. The animals that live in the water become less and less.	Microstructure substitution Microstructure consolidation	**Deleted:** lifeless.
3. People throwrubbish to the rivers. They pollute the water.We can't swim in the sea anymore because the water is dirty. If we swim in the polluted water, we will hurt our skin.		**Deleted:** water.
.....		
Solutions:		
1. Don't throw the rubbish and sewage into the rivers.		**Deleted:** Problems: 1. There are a lot of germs in the polluted water. If people drink this water,it will cause different kinds of illnesses. 2. The animals that live the water become lifeless. They will be less and less. 3. We can't swim in the sea anymore because the water is dirty. If we swim in the polluted water, we will hurt our skin.
.....		
(http://home.gwu.edu/~annacre/pollution.htm)		
(http://www.flickr.com/photos/marelles/2215563719/)		

This means that even when surface level non-revision oriented comments were made, there was an increase in content and meaning revisions at the macrostructure level. There was also a significant correlation between non-revision oriented surface level comments and surface changes, especially formal level changes ($r = 0.616$ & $r = 0.576$, $p < 0.05$). To explain this finding, qualitative data was examined, as shown in Table 12.

The excerpts from 6X in Table 12 show one of many instances where surface level non-revision-oriented comments brought about revision in content and meaning at the microstructure level and surface changes at the formal level. An interesting observation was that a rush of activity occurred after a teacher posted a comment. This may have been due to encouraging remarks that may not necessary have been revision-oriented, or students realizing that they were being monitored. This may be an area for future research on how the teacher's presence may affect student learning in an online environment. In either case, teacher feedback spurred a wide range of revisions followed by several cases of formatting, which were omitted from Table 12 due to limited space.

Thus, even non-revision-oriented comments at the surface level can elicit a variety of revisions. In contrast to revision carried out when a text is finished, the activities on the wiki platform revealed a complex collaborative process during the composition and not just a review of a completed text. This may also be related to an unexpected significant positive correlation between management and other non-related comments with micro-structural content and meaning changes for Class 5X and Class 5Y (5X: $r = 0.475$, 5Y: $r = 0.664$, $p < 0.05$), and with meaning-preserving surface changes for Class 6X ($r = 0.453$ & $r = 0.602$, $p < 0.05$). As shown in the excerpts from the posted comments of Class 5Y in Table 6 and Class 6X in Table 7, posting management and other non related comments played a role in establishing communication in team-building and other affective domains. This may again point to further research on how online communication can help enhance the affective domain promoting social interaction, a prerequisite in collaborative group learning (Kutnick et al. 2008).

Outcome of the writing performances

Without a control group, it was difficult to address the sub-question (4) Is there an association between revisions and improvement in students' writing? To compensate for this limitation, two pieces of non-wiki group writing on different topics written before the introduction of the wiki technology and two pieces of wiki group writing collected after three months of wiki intervention were analyzed. Table 13 shows the average group writing scores using analytical methods for both wiki and non-wiki group writing by different classes. The total analytical grand score shows the total added scores of content/organization, language and visual graphics. One cautionary note is that the students' writing performance tended to improve over time, and this alone would not indicate the success of the revision process. Nevertheless, it was worthy of note that, as recorded in

Table 13 Group Writing Evaluation of Non-wiki and Wiki Group Writing by Class

Items evaluated	Group writing evaluation by Class (p value) $N = 20$				
	Class	NGW (SD) mean score	WGW (SD) mean score	T value	Effect size/Eta square
Content/organization	5X	20.63 (3.86)	21.1 (4.85)	−0.35	−0.04
	5Y	18.81 (3.98)	21 (5.7)	−1.87	−0.25
	6X	20.8 (3.29)	24.45 (3.02)	−3.81	−0.67*
Language	5X	12.53 (1.95)	13.3 (1.92)	−1.23	−0.15
	5Y	12.32 (2.56)	13.35 (1.27)	−2.04	−0.27
	6X	11.8 (2.07)	14.15 (1.76)	−4.57	−0.93**
Visual graphics	5X	1.86 (1.07)	3.15 (1.42)	−4.01	−0.73*
	5Y	2.9 (0.64)	2.65 (1.35)	0.79	0.32
	6X	1.5 (1.0)	2.65 (1.69)	−2.5	−0.36*
Total analytical grand scores	5X	35.01 (5.13)	37.55 (6.13)	−1.39	−0.17
	5Y	34.03 (6.45)	37.0 (7.52)	−2.00	−0.25
	6X	34.0 (5.5)	41.25 (4.55)	−5.45	−1.35**

NGW non-wiki group writing, *WGW* wiki group writing, *SD* standard deviation, *t* t value

Significant at $p < 0.05$ and ** significant at $p < 0.001$

Table 13, for 5X, 5Y and 6X, wiki group writing mean scores improved compared with the non-wiki group writing, except for 5Y's visual graphics and photos, which recorded a slight but non significant decline. Table 13 shows the result of the paired sample t test comparing the difference between the mean score for non-wiki group writing and that for wiki group writing by class, with t values and effect sizes shown on the most right hand column with * indicating significance at $p < 0.05$ and ** indicating significance at $p < 0.001$.

For both Class 5X and Class 5Y, a paired sample t test yield only marginally significance, except for visual graphics and photos in the case of Class 5X. This may have been due to the small sample sizes of 20 pieces of group writing in each class. However, when the data for classes 5X and 5Y were combined ($N = 40$), there was a statistically significant improvement between non-wiki to wiki group writings for items content meaning organization; from 34.52 (SD = 5.78) to 37. 28 (SD = 6.77), t = −2.37, and effect size of −0.14, language; from 12.42 (SD = 2.25) to 13.33 (SD = 1.61), t(39) = −2.26 and effect size of −0.13 and visual graphics and photos; from 2.38 (SD = 1.02) to 2.9 (SD = 1.39), t = −2.04 and 26 effect size of −0.12 with $p < 0.05$. For Class 6X, all the items showed significant improvement for wiki group writing, as shown in Table 13. The effect sizes are substantial, and the wide range of effect size maybe due to the small sample size. The following are some sample quotes from student and teacher interviews that may illustrate the findings:

- I could read their work fluently instead of having a lot of problems. The ideas are delivered quite fluently even though they have a few grammar mistakes. (6X teacher).
- One group in 5Y, which was often off task and argued, excelled on the wiki. They put in more effort than usual, and their work was of a good standard. 6X students are highly motivated when writing with the wiki. (English coordinator).
- I have done another group writing after the wiki. Their writing has improved and all of them hand in their group work. Before, some of them couldn't finish it, but after the wiki they all finished the group writing. (5Y teacher).

The findings showed that the more comments posted, the more revisions made, and the next assumption is that the more revisions made, the better the quality of students' writing. Although the improved group writing cannot be attributed solely to the effect of revisions since student learning improves over time, it is a positive sign, and it is hard to deny the influence of revision on writing performance, as some of the students and teachers comments suggest. Further research on the association between the subscales of categorized revisions and writing performance with a larger sample size and a longer time frame may help to show the significant effect of the revision process on writing performance.

Conclusion & implications

To answer the research question; To what extent does a wiki, with its commenting and editing features, help upper primary school L2 writers during collaborative writing in an English language classroom? the findings are summarized below specifically to address the sub-research questions.

1. What kinds of comments are posted?

In this study, out of three upper primary classes involved in collaborative writing with a wiki, two classes recorded more content and meaning level comments than surface level comments, and these comments tended to be revision-oriented in nature.

2. What kinds of revisions are made on the wiki platform?

Similarly, in all three classes, there tended to be more content and meaning level changes than surface changes among the types of revisions that students made. There tended to be more macrostructural than microstructural content and meaning changes, while for surface level changes, there were more formal changes involving spelling, punctuation, grammar and formatting.

Although the number of comments and revisions varied depending on the topic and genre of the writing, the distribution of percentages of types of categories remained consistent between the two writing tasks for both comments and revisions. This may have been due not only to PBworks' functions in providing writers with spell checks to lessen their cognitive load, but also to the ease with which the Internet allows a host of ideas and information to be made available, enabling writers to focus on analyzing and evaluating the content for their own writing. As shown in the qualitative data analysis, the students felt at ease communicating through technology. This is supported by other studies with adults and adolescents that found that communicating through technology tended to result in more content and process discussions (Jones et al. 2006), and that peer-feedback activated self-corrections (Yang et al. 2006).

3. Is there an association between comments and revisions?

Correlation analysis showed that in all classes, the more comments posted by the students, the more the types of revisions recorded per 100 words. Significant positive correlations were also seen between posted comments and microstructure changes at the content and meaning level and between posted comments and meaning preserving and formal changes at the surface level. Although more content and meaning revision changes than surface changes were recorded, there were strong indications that the students continued to correct grammar, spelling and punctuation at the surface formal level as well. Closer examination of the qualitative data showed that even surface level non-revision-oriented comments may have spurred the revision process.

4. Is there an association between revisions and improvement in students' writing?

Although group writing evaluation alone cannot determine the outcome of the revision process, a significant improvement was noted in students' group writing using a wiki compared with students' non-wiki group writing before the introduction of the wiki. These are promising outcomes, and it is hard to deny the influence of revisions on the students' writing. Further long term research may bring these points out more strongly.

One of the limitations of the study was the lack of a control group, which was due to ethical reasons, in that the technology was offered to all classes on a voluntary basis. Nevertheless, the qualitative data may have helped to support the findings and illuminate some of the complexity of the revision process. Another limitation was that due to the small sample size, there was a lack of strong statistical support, and it is difficult to generalize the findings beyond these classes. Future longitudinal studies aimed at observing students' developmental writing process may provide a more complete picture.

The asynchronous nature of the online wiki platform enabled students and teachers to provide feedback anytime anywhere during the writing process. Although a wiki may provide tools and affordances for easy commenting and editing for writers, this does not automatically lead to meaningful revision, and a teacher's instructional role is still important in scaffolding young L2 students with the appropriate skills. This study with primary students found that revision oriented comments helped the students to make meaningful revisions. This is supported by other studies with adults and adolescents in

trained peer response (Berg 1999; Min 2006), in which explicit teaching instruction that encouraged revision-oriented peer comments, both at the content and the surface level, helped to enhance effective peer feedback for meaningful revision. At the same time, the provision of timely and constructive teacher feedback tended to spur various revision activities, a finding that has also been observed among older students (Paulus 1999; Tsui and Ng 2000). Combined with appropriate teacher's instructional roles such as providing timely feedback and guiding students to give revision oriented peer-feedback, wiki technology with its commenting and editing functions can be a powerful tool for collaborative writing among young L2 writers.

Tracing primary school students' peer comments and revisions on the wiki platform revealed a complex collaborative process during the actual composition of writing, and not just during the reviewing process of an already completed text. The wiki's history pages and its tracking function provided teachers with information on how students co-constructed and co-revised during their composing process, and helped in assessing the development of the group writing process, a task that may be difficult to monitor with traditional group writing. This can help teachers decide on the kind of support to be given, and provide immediate feedback when necessary to support young L2 writers during the course of writing, and not at the end when the product is finished.

Appendix 1

Teacher provided wiki rules

1. I will not use my real name, address, email address or telephone number.
2. I will not give my password to anyone else. I will not change the password assigned by my teacher.
3. If I forget my password, I will ask my teacher to give me a new password.
4. I will not use another person's Wiki name and password. I will not ask other students to tell me their passwords.
5. When I write about other students and teachers in our Wiki group, I will use their Wiki names. I will not use their real names, addresses, email addresses or telephone numbers.
6. When I write about other people, I will not use their full names, addresses, email addresses or telephone numbers. I will use their titles (e.g. "Mum", "Dad", "Aunty") or their given names (e.g. "A-Ming", "Mary", "Sam").
7. I will write encouraging comments about other students' work on Wiki. If they have made a mistake, I will help them to see the mistake and change it without being unkind.
8. I will follow the teachers' instructions and use the Wiki correctly.
9. I will add photos, pictures, videos, sound files or music that are free to use. If they are not free, I will get permission to upload them from the owners, or I will make my own photos, pictures, videos, sound files or music.
10. If I see information on our Wiki that should not be there, I will tell my teacher. I will not change or delete it. That is the teacher's job.
11. I agree to participate in our Wiki and I give permission for my work and comments to be viewed by other students and our teachers as well as parents and other interested members of our community.

I have read the TCN Wiki Rules. I understand the rules and I agree to obey the rules.

Write your Wiki name to show that you agree. Write the date, then click the "Add comment" *button.*

(Adapted from XXXX Primary School Collaborative Writing 2008-2009).

Appendix 2

See Tables 14 and 15.

Table 14 Analytic scale in evaluating group writing

A. Content & organization	6X Wiki Group H	Water Pollution By MJSS Don't you think water is getting as black as night? We need to take action, and so do you and I
1. Original and creative ideas	5	Causes and solutions
2. Well developed and elaborated ideas with details	3	People throw rubbish into the sea.Factories produce too much waste water and oil into the sea too. When the tankers have accidents, a lot of oil will leak out into the ocean and make the water dirty.If we still causing water pollution, sea animals will die soon.
3. Consideration of audience and purpose(s)	3	In order to make the water cleaner and cleaner, we shoudn't throw garbage and dump toxic waste into the sea.We can also tell our family or other people that water pollution is getting worse now
4. Appropriate use of paragraphs to organize ideas	4	We should do something as quickly as possible before some bad thing happen.Hope you will share this poster to your friends
5. Logical presentation of ideas	4	'You do well,the world will well'
		Reader:people in the world
6. Appropriate use of connectives to give cohesion to the text	4	Picture 1:http://www.healthhype.com/guide-to-...logy.html
7. Appropriate use of genre and its conventions	4	Picture 2:http://www.airheadsscuba.com/kayesite1wtrpoll.html
C. Language		
1. Good choice of vocabulary	4	
2. Variety of phrase and sentence patterns	4	
3. Appropriate use of language (grammar: tense agreement, articles, pronouns, prepositions, etc.)	3	
4. Correct spelling and punctuation	4	
5. Use of imagery, simile or metaphor	3	
D. Visual Graphics & photos	3	
E. Grand-total	48	

Adapted from Tompkins (2004). *Teaching writing: balancing process and product* (4th ed.). Upper Saddle River, N.J.: Pearson/Merrill/Prentice Hall

Excellent-5, Good-4, Average-3, Below Average-2, Poor-1, Not used-0 13 items x 5 = 65 (full score)

Table 15 Rubrics for the scores

Ratings/ Area	Content & Organization	Language	Visual Graphics & Pictures
Excellent-5	Excellent use of the content & organization items. The items are used appropriately and consistently with few errors	Excellent use of the language items. The items are used appropriately and consistently with few errors	Excellent use of both relevant graphics and pictures to illustrate the content and bring out more richness in their writing project with the use of different colours, font size etc
Good-4	Good use of the content & organization items. The items are used appropriately with some errors	Good use of the language items. The items are used appropriately with some errors	More sophisticated use of relevant graphics & pictures to help illustrate the content with the use of different colours, font size etc
Average-3	Basic use of the content & organization items. The items are used with errors but do not interfere with the readers' comprehension of the text	Basic use of the language items. The items are used with errors but do not interfere with the readers' comprehension of the text	Some relevant graphics & pictures are used with the use of different colours, font size etc
Below Average-2	The content & organization items are used inconsistently with errors	The language items are used inconsistently with errors	Either relevant graphics/ pictures or different colours & font size etc. are used
Poor-1	The content & organization items are used inconsistently with errors and interfere with readers' comprehension of the text	The language items are used inconsistently with errors and interfere with readers' comprehension of the text	Either irrelevant graphics/ pictures or different colours & font size etc. are used without much effect
Not used-0	None of the component is used	None of the component is used	None of the component is used

Appendix 3

See Table 16.

Table 16 Types of revisions

Level of changes	*Meaning changes:* involve adding of new content or the deletion of existing content		*Surface changes:* changes that do not bring new information to a text or remove old information	
Sub-categories	*Macrostructure Change:* major change that would alter the summary of a text. Alter the overall direction and gist of the text. Will affect the global meaning of the text and influence the summary and interpretation of the content	*Microstructure Changes:* Meaning changes that would not affect the overall summary, gist, or direction of the text. Simple adjustment or elaborations of existing text and would not affect the overall interpretation of the text. May involve the use of cohesive ties, causing sentence sequences to be understood as consistent and parallel connected discourse	*Meaning-Preserving Changes:* Paraphrase the original concepts in the text by making them implicit or explicit, without altering the meaning. No new information is brought to the text. Primarily syntactical or lexical changes	*Formal Changes:* Changes involving conventional copy-editing operations
1. Additions	If the ideas are added or elaborated that will change the summary of the text	If the ideas are elaborated with additional ideas but not big enough to change the summary of the text	When word or phrases are added without changing the meaning of the concept or the idea	Spelling: Any correction in spelling Grammar (tense, number & modality): verb tense agreements, singular & plural changes, modality, e.g. will, be, can, should, etc. Punctuation: change in capitalization, periods, commas, etc. Abbreviation: replacing forms of abbreviation and numbering & bullets. Format: any spacing between lines, words, letters, punctuations, etc. Any visits indicated by wiki as formatting taking place

Table 16 continued

Level of changes	*Meaning changes:* involve adding of new content or the deletion of existing content		*Surface changes:* changes that do not bring new information to a text or remove old information
2. Deletions	When ideas are deleted and change the overall summary of text	When word or phrases are deleted and change the meaning of the concept or idea, but not big enough to change the summary of the text	When word or phrases are deleted without changing the meaning of the concept or idea
3. Substitutions	If existing ideas are replaced by different ones and change the overall summary of the text	If existing words or phrases are replaced by different ones to change the meaning of the original ideas	If existing words or phrases are replaced by different ones without changing the meaning of the ideas
4. Rearrangements	If existing words or phrases are reordered, reorganized, re-sequenced, deleted but appear again in other parts and change the meaning of the original ideas enough to change the summary of the text	If existing words or phrases are reordered, reorganized, re-sequenced, deleted but appear again in other parts and change the meaning of the original ideas, but not enough to change the summary of the text	If existing words or phrases are reordered, reorganized, re-sequenced, deleted but appear again in other parts without changing the meaning of the original ideas
5. Expansions	Distributional changes occur where what has been compressed into a single unit now falls into more than one unit. The change will affect the summary of the text	Distributional changes occur where what has been compressed into a single unit now falls into more than one unit and changes the meaning of the ideas, but not enough to change the summary of the text. Examples are when ideas are being elaborated with additional ideas	Distributional changes occur where what has been compressed into a single unit now falls into more than one unit. If the same ideas are elaborated then treat it as expansion of existing ideas without changing the meaning of the original ideas
6. Consolidations	Opposite of expansion where two more units are consolidated into one unit. Examples are sentence-combining and when some summarization occurs and changes in the direction or overall gist of the text	Opposite of expansion where two more units are consolidated into one unit and change the meaning of the ideas, but not enough to change the summary of the text. Examples are sentence-combining, but not affecting the original summary of the text	Opposite of expansion where two more units are consolidated into one unit. Examples are sentence-combining without changing the meaning of the text

Adapted from Faigley and Witte (1981). Analyzing Revision. *College Composition and Communication, 32*(4), 400–414

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