Using Weblogs to Promote Critical Thinking through Asynchronous Online Discussion

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Findings from a few studies seem to indicate that weblogs have positive effects on learners by inducing them to think critically (Huffaker, 2008; Woo & Wang, 2009). In view of this recent interest, this paper aims to analyse the extent of bloggers and non-bloggers' critical thinking (CT) and how different weblogging strategies affect bloggers' CT. Forty four tertiary students participated in this study. The bloggers' posts and non-bloggers' written copies from the study were coded according to Newman, Webb, and Cochrane's (1996) CT model. In order to compare bloggers' writing reflections, four strategies were applied as follows: (a) blogging within a group with no feedback or extra influence, (b) blogging within a group with groupmates' comments, (c) sharing ideas with groupmates in the Sharing Corner at the weblog space before blogging individually in their own group, and (d) blogging to reflect on the groupmates' comments received. The results indicated that in promoting CT, blogging is seen to be more effective than traditional writing particularly if bloggers receive their group members' comments.

Key words: blogging, blogging strategies, critical thinking, online discussion

INTRODUCTION

It is generally agreed that students learn various knowledge and skills in college, but whether they learn to think critically is not certain. In traditional classrooms, there is always a contradiction between content coverage and CT. On the one hand, instructors arrange to cover more materials and analyze them critically, but on the other, they have to struggle with increasing class size, restricted funds, and limited contact time with students (Mandernach, 2006). To struggle with these barriers, there is a need to look for innovative ways to integrate different instructional strategies to enhance students' learning and CT in an effective way. In doing so, advanced technology has produced a wide range of online tools to help instructors promote students' CT by overcoming the restrictions of traditional classrooms.

Studies show that weblogs as an online tool has the potential to engage students in a wide range of activities that promote students' CT (Wang, Woo, & Zhao, 2009; Woo & Wang, 2009). However, their role in promoting CT has to be closely examined through more research. In view of this need, this paper seeks to address the following questions: (a) Do different blogging strategies affect students' CT? (b) Is there a significant difference between bloggers and non-bloggers' CT?

REVIEW OF RELATED STUDIES

Critical Thinking

In the new age of information, CT has been considered as one of the most significant competences. We need CT skills to solve problems (Wang et al., 2009; Woo & Wang, 2009) and to support opinions. CT is a powerful thought process in considering all available information before making a decision (Çubukcu, 2006). As CT is a contextual construct by itself, giving a definition to it has always been a problem (Woo & Wang, 2009). Staib

(2003) describes CT as "the art of thinking about your thinking while you are thinking in order to make your thinking better" (p. 643). In addition, Çubukcu (2006) says that CT is an effective, organized, and logical cognitive process that allows us not only to consider our thoughts, but also those of others. CT allows us to use logic in determining what to believe or what to say about a subject. In the same light, Connerly (2006) defines CT as the well-organised mental activity to evaluate arguments or propositions and make judgments that can lead to the development of ideas and taking action. Some of these authors define CT based on values and cultures. Some identify it as a form of philosophy, while others see it as a skill. Therefore, CT can be associated with ability, art, skill or all of them in different contexts (Woo & Wang, 2009). Related to previous definitions, the pedagogical aspect of CT is considered a skill to "identify issues and assumptions, recognize important relationships, make correct inferences, evaluate evidence or authority and deduce conclusions" (Tsui, 2002, p. 734). Based on these definitions, CT skills can be classified into two parts: (a) skills to analyze, argue, synthesize, evaluate and apply; and (b) skills to direct behaviours (Woo & Wang, 2009). In sum, CT is a purposeful thought process that includes interpretation, analysis, evaluation, and inference based on the examination of conceptual, methodological, and contextual considerations (American Philosophical Association, 1990).

This study focuses on the pedagogical aspect of CT to investigate how students are able to analyze information, judge the quality of an argument, identify reasons and draw conclusions in online discussions. In the context of this study, CT is quantifiable and measurable to provide information for the extent of the CT that weblogging may induce.

Weblogs and Critical Thinking

The prevalence of information and communication technology (ICT) has availed increasing information to students and assisted them in thinking critically and using information cautiously (Mandernach, 2006). Students

must use CT skills to analyze and compare information, to respect different ideas, and to solve their problems (Wang et al., 2009). Unlike traditional classrooms, online tools give students a chance to develop their CT and master their learning process in their own pace. Moreover, ICT tools have the advantage in reducing students' tension and increasing peers' interaction (Horton, 2000). Therefore, selecting the right ICT tool is a crucial factor to consider in the classroom (Wang, 2008).

In recent years, the proliferation of weblog use has changed education in some ways. Blogs, by their nature, not only facilitate users' share of information and collaboration, but also engage bloggers in in-depth meaningful interactions which may lead to thinking critically. Wang and Woo (2009) believe sharing information and discussing it on weblogs can enhance students' writing skills and promote their CT abilities. In investigating CT and knowledge construction, three types of interactions at three different levels are considered: individual, group and class level (Wang et al., 2009). Also, they mentioned that weblogging may promote students' CT but not all students think critically when they blog. The asynchronous feature of weblog gives students more time to reflect on others' opinions and this feature may help them contribute more critically in their online discussions. Another study found evidence of weblogging in improving students' CT by making creative risks and using language in sophisticated ways (Shefler, 2006). In doing so, students can achieve skills that may help them to read carefully, answer critically and write extensively through practice. Weblogs can also provide a convenient means for students to enhance their social interaction and collaboration, to analyze their prior knowledge, and to discuss together. This sort of discussion on combining and making novel ideas may train students to think critically (Huffaker, 2008). In addition, weblogs facilitate students' collaboration and create more in-depth interaction among them to "question and challenge each other's thinking" (Lai & Wang, 2008, p. 2).

Furthermore, it is shown that different blogging strategies may have different effects on bloggers' writing. For instance, different weblogging

strategies were applied in four secondary school classes with each class subjected only to one strategy. The strategies were: (a) individual blogging with no feedback, (b) blogging in a small group with other groupmates' comments, (c) blogging with a class with all classmates' comments, and (d) class blogging with teacher's comments (Wang & Woo, 2008). The result indicated that weblogs can promote CT when students regularly post to their weblog and give comments to other groupmates. Also, the blogging topics have a significant role in distinguishing the types of CT applied by students. Students may apply different CT traits such as linking ideas, justification, and critical assessment to different topics (Woo & Wang, 2009).

In short, the use of weblog creates opportunities for the learners to promote their CT and knowledge co-construction; it helps learners share information, negotiate, and revise their postings (Wang et al., 2009). In the present study, four different blogging strategies were applied. The first two strategies are the same as Woo and Wang (2008), while the 3rd and 4th strategies are different. All these strategies well match the purpose of the study.

METHODOLOGY

Participants

The participants of the study comprised forty four undergraduate BA (English). They were Malay, Chinese or Indian who had been learning English as a second or third language. English is an important second language to them as it is widely used in trade and commerce in Malaysia, and is a medium of instruction in some courses in universities. Students aged from 22 to 26 (45.9% male and 54.1% female) and were enrolled in an obligatory course. All students seemed to be familiar with IT and online learning. Most of them (97%) had personal computers, and 60% of them had home Internet access.

The course ran twice a week for two hours each and lasted 14 weeks,

comprising face-to-face and fully online sessions. The former was conducted in a computer lab. Both bloggers and non-bloggers attended the sessions but non-bloggers did not participate in weblogging. As for the online sessions, bloggers participated independently without going to the lab.

Procedure

During the face-to-face sessions, and before the registration on the Web, the instructor, who is more like a facilitator, explained the context of learning. For example, they were told that weblogging is a compulsory part of their assignment which replaced the traditional written copies. After that, bloggers were trained to post, write, comment and share ideas with classmates in a discussion forum while nothing was mentioned about applying CT skills. Non-bloggers were to write in a traditional way. The weblog was set up at E-blogger (www.blogger.com) which allowed the students to post for free. All bloggers were given hands-on practice before doing their weblog assignments. The class was divided into four groups of eight as bloggers (Group 1 to 4), and one group of seven as non-bloggers (Group 5) randomly to eliminate chance factors. A student was dropped from Group 5, because his writing was off topic. The weblog addresses showed students' groups and their numbers in the group, for example, Angelia's name is shown as G4N2 which means that she was the second member in Group 4.

Blogging Topics and Strategies

The debatable topics have a great effect in promoting in-depth learning through discussions. In other words, topics should be not only based on students' background knowledge and their interest, but also "relevant, meaningful, challenging and controversial enough" to provoke students' thoughts in online discussions (Wang et al., 2009, p. 102). Four controversial topics were chosen based on students' suggestions and considering all the above factors. This research study is based on the result of students' writing

reflections on one of the four topics, that is, 'How is your generation different from your parents' generation?'. The other three topics are not included in the analysis of this study. Figure 1 shows a screen capture of a Group 1 student's posting.

FIGURE 1
Screen Capture of a Student's Posting

To compare bloggers' writing reflections, instructors should plan authentic tasks to support and challenge students' ways of thinking (Mandernach, 2006). Therefore, to investigate the extent of weblogging impact on CT, four strategies were applied as follows: (a) blogging within a group with no feedback or extra influence, (b) blogging within a group with groupmates' comments, (c) sharing ideas with groupmates in the Sharing Corner at the

weblog space before blogging individually in their own group, and (d) blogging to reflect on the groupmates' comments received. To have students in each group follow the instructions systematically, instructions for activities were posted on the weblog by the instructor for each group (see Table 1).

TABLE 1
Instructions and Time Table for Weblogging for Group 4

Instructions	Time Table
Post your writing	March 3rd-6th
Comment on you groupmates' posting	March 6th-8th
Post your second writing to reflect on the groupmates' comments received	March 8-10th

Data Collection

Blog posts from the study were coded according to Newman et al. (1996) CT model. This protocol was based on an earlier work from Garrison's (1992) CT model that contains five stages: identification, definition, exploration, evaluation and integration (Marra, Moore, & Klimczak, 2004). The first reason for choosing this model was that it represents an attempt to ascertain the existence of thinking meaningfully in an online discussion without focusing on the acquisition of the content. Second, the scheme was easy to apply because codes were based on understandable and particular definitions (Marra et al., 2004). Third, the model contains a list of comprehensive indicators that make CT identifiable and quantifiable in every piece of writing (Woo & Wang, 2008). Based on the Newman et al. (1996) model, after coding a passage, a CT ratio can be calculated. CT ratio = $(x+ - x-) / (x+ + x-)$ where $x+$ and $x-$ are the number of positive and negative statements respectively. CT ranges from -1 to +1, meaning that the highest level of CT can occur when the positive ratio approaches 1. To overcome the ambiguity in the application and interpretation of codes to reach a consensus on all codes, inter-rater coding procedure was applied and inter-rater coding check was conducted (Chi, 1997). By definition, inter-coder reliability means to what extent different coders come up with the same coding decisions in

coding the same content (Rourke, Anderson, Garrison & Archer, 2001). In this study, if two coders did not use the same code, they discussed the difference, and tried to reach an agreement. In case of agreement, they considered the change; otherwise, the original codes were kept (Chi, 1997; Wang et al., 2009).

DATA ANALYSIS

All students' postings on 'How is your generation different from your parents' generation?' were collected and coded based on the Newman et al. (1996) CT model. This model instantiated CTindicators by means of 40 codes in different categories such as importance, linking ideas and critical assessment (see Appendix). In this study, the unit of analysis is a statement or a sentence that matches the indicator description. That is, when a sentence or statement matches the indicator description it is labelled based on the codes given in the model. For example, if a statement making a claim is obtained from new ideas used in the process, it is coded as N+ that represents CT under the category "Novelty; new info, ideas, solutions". Otherwise, it is be coded as N- if the coded statement detracts from new ideas (see Table 2).

TABLE 2
Newman et al.'s (1996) CT Model Coding Example

<R+ in my opinion, our new generation is totally different with our parent generation in many ways (L+). For example, the technology in our generation are more advance than our parent generation (J+). Nowadays we have LCD, plasma TV, laptop even touch phone but in older generation, there is nothing like what we have now(J+, C+). There are many new technologies around us in present generation and we are rely on those technologies but our parent did not do so (N-, I-). Besides that, they were lack of entertainment compare to our generation (N+, L+). Now we can online to watch movie, listen music, playing game even chat with our friends. But our parent live healthy comparatively because they didn't expose to too much entertainments (J+, C+, N+) R+>

After identifying all categories of CT based on the model, analyzing the

data was carried out in different groups as follows:

Group 1

For Group1, each student posted his/her own writing individually and independently without extraneous influence, meaning that they were not required to post a reply. As seen from Table 3, 13 significant CT traits (including 8 positive and 5 negative) are detected. Other traits with % score < 1 are considered insignificant such as R-, O- and L-. Students' CT seemed to congregate around three thinking traits: justifying view points (J+), referring to new idea (N+) and applying critical assessment (C+) with CT ratios 34.25, 16.02 and 15.47 respectively. Also, negative criticalness like J-, C- is detected with the same CT ratio 2.21. That is, the 11th rank is absent. The observed difference between J+ and J-, and C+ and C- shows that positive traits were considerably more than negative ones (see Table 3). The result shows bloggers provided a lot of examples and evidence to justify their statements about the generation gap. Furthermore, C+ implies that most received information was critically assessed before it was accepted. For instance, a member in a group posted:

> Besides, the Internet can make the life easier for everyone such as paying our bills online, using online application for job, competition, and so on. In addition, the Internet also provides us with the space for online chatting, making friends and searching information (these are what I always do). It makes our life easier. However, during my parents' generation, they were not provided with all this facilities, they had to communicate with each other using telephone, letter, fax and other methods that are not convenience and takes time…

TABLE 3
Analysis of CT for Students in Group 1

CT Indicator	R+	R-	I+	I-	N+	N-	O+	O-	A+	A-	L+	L-	J+	J-	C+	C-	Total
Sub-Total	7	0	3	5	29	2	10	0	9	6	12	0	62	4	28	4	181
% Score	3.87	0.00	1.66	2.76	16.02	1.10	5.52	0.00	4.97	3.31	6.63	0.00	34.25	2.21	15.47	2.21	100
Importance	7	N.I.	12	9	2	13	5	N.I.	6	8	4	N.I.	1	10[a]	3	10[a]	
CT	1.00		-0.25		0.87		1.00		0.20		1.00		0.88		0.75		

Note. N.I. = Not Important, CT = Critical Thinking
a Shows traits with equal ranks.
Every CT indicator has a positive or a negative representation. CT ratio= (x+- x-) / (x+ + x-) as displays in the last row.

Group 2

As for group 2, each blogger was required to comment on their fellow groupmates' posts while a recipient of comments was not required to post a reply. It can be seen from the data in Table 4 that J+, C+ and O+ are considered as the first domineering traits with CT ratios 30.53, 14.74, and 10.53 respectively (see Table 4). In posting comments, most bloggers just identified areas of agreement and disagreement; however, more agreement was detected than disagreement. Some were far beyond this in putting up comments, they added their own justification and elaboration and some asked the writer to clarify their point of view and elaborate it more. For example, G2N3 made a comment about culture differences:

Hi friend, I totally agree with your statement that each generation has its own identity and culture .To me, it is the mean to a lot of problems and misunderstanding …this is normal…I think it would be more interesting if you add up some more other differences.

TABLE 4
Analysis of CT for Students in Group 2

CT Indicator	R+	R-	I+	I-	N+	N-	O+	O-	A+	A-	L+	L-	J+	J-	C+	C-	Total
Sub-Total	6	0	5	1	6	1	10	0	9	4	9	0	29	0	14	0	95
% Score	6.32	0.00	5.26	1.05	6.32	1.05	10.53	0.00	9.47	4.21	9.47	0.00	30.53	0.00	14.74	0.00	100
Importance	6[a]	N.I.	8	10[a]	6[a]	10[a]	3	N.I.	4[a]	9	4[a]	N.I.	1	N.I.	2	N.I.	
CT	1.00		0.67		0.71		1.00		0.38		1.00		1.00		1.00		

Note. N.I. = Not Important, CT = Critical Thinking
a Shows traits with equal ranks.
Every CT indicator has a positive or a negative representation. CT ratio= (x+- x-) / (x+ + x-) as displays in the last row.

Group 3

For this group before posting, bloggers shared their ideas with classmates in a discussion forum or in a course Sharing Corner. First they exchanged their ideas with each other, asked and answered questions on the weblog space created by all groupmates. Then, they posted their own writing. The result indicates that, 11 CT traits (including eight positive and three negative criticalness) are found to be significant. Their CT seemed to center around these positive traits: J+, C+, and N+ with CT ratios 29.10, 16.36 and 12.72

respectively. Also, some equal ranks in positive and negative criticalness were detected; O+, A+ and L+ considers as the 4th, while R+, J-, C- as the 7th top traits as shown in Table 5. For this group, bloggers' forum and sharing information is considerable as bloggers used a lot of examples to justify the generation gap. This allowed the students to express their ideas in great depth with a series of postings built up on one another and resulted in the high use of CT. For instance, G3N5 wrote in the Sharing Corner: "People from new generation are much more open minded….". A member in a group replied: "Yup…agree…could you give us an example or more in what ways present generations is more open minded than older generation…". G3N6 posted:

> In my opinion, open minded in a sense that we accept something easily. But we have to think critically & wisely before accept that things…" G3N1 wrote: "But being too open minded could have serious consequences like misunderstanding between two generations…

TABLE 5
Analysis of CT for Students in Group 3

CT Indicator	R+	R-	I+	I-	N+	N-	O+	O-	A+	A-	L+	L-	J+	J-	C+	C-	Total
Sub-Total	3	0	1	2	7	0	4	0	4	0	4	0	16	3	9	3	56
% Score	5.36	0.00	1.79	3.57	12.50	0.00	7.14	0.00	7.14	0.00	7.14	0.00	28.57	5.36	16.07	5.36	100
Importance	7[a]	N.I.	11	10	3	N.I.	4[a]	N.I.	4[a]	N.I.	4[a]	N.I.	1	7[a]	2	7[a]	
CT	1.00		-0.33		1.00		1.00		1.00		1.00		0.68		0.50		

Note. N.I. = Not Important, CT = Critical Thinking
a Shows traits with equal ranks.
Every CT indicator has a positive or a negative representation. CT ratio= (x+- x-) / (x+ + x-) as displays in the last row.

Group 4

In this group, each member put up his/her writing on weblogs and was required to reflect on the comments received and not to revise their first post, but to produce one more post based on the comments received. That is, three factors are examined as follows: bloggers' posts, bloggers' comments and producing one more post.

TABLE 6
Analysis of CT for Students in Group 4

CT Indicator	R+	R-	I+	I-	N+	N-	O+	O-	A+	A-	L+	L-	J+	J-	C+	C-	Total
Sub-Total	10	2	7	0	21	4	12	0	9	11	9	1	44	6	16	7	159
% Score	6.29	1.26	4.40	0.00	13.21	2.52	7.55	0.00	5.66	6.92	5.66	0.63	27.67	3.77	10.06	4.40	100
Importance	6	13	9[a]	N.I.	2	12	4	N.I.	7[a]	5	7[a]	N.I.	1	11	3	9[a]	
CT	0.67		1.00		0.68		1.00		-0.10		0.80		0.76		0.39		

Note. N.I. = Not Important, CT = Critical Thinking
a Shows traits with equal ranks.
Every CT indicator has a positive or a negative representation. CT ratio= (x+- x-) / (x+ + x-) as displays in the last row.

Table 6 shows that CT in bloggers' first posts congregates around these positive traits: J+, N+ and C+ with CT ratios 27.67, 13.21 and 10.06, respectively which implies a high positive criticalness but what is important here is students' postings after receiving comments; otherwise, no difference can be seen between group 1 and 4. Comparing bloggers' first posts and the second ones after receiving comments indicated that Group 4 applied more

new idea (N+), and critical assessment (C+) in producing their second posts. Basically, bloggers not only showed their agreement and disagreement in their comments, but also applied high positive criticalness; most applied justification (J+), critical evaluation (C+) and new idea for discussion (N+) in their comments. It seems plausible to say comments have a positive effect on waning off ambiguity, creating new ideas for discussion, justifying judgment and providing examples in bloggers' postings and comments have a crucial role in bloggers' CT.

Group 5

In Group 5 (non-bloggers Group), students' written copies were collected in class and coded the same way as all the bloggers' groups. Compared to other groups, the lowest positive criticalness is found in this group (78.04 %). The top three CT traits are J+, C+ and I- with respective CT ratios 37.40, 17.07 and 8.94. As Table 7 shows, negative CT traits only appear in this group as the top domineering CT traits, and this indicates that non-bloggers focused on unimportant issues in their arguments. It is also observed that the number of negative traits (I-, R-, N-,A-, L-, J-, C-) was more in non-bloggers, implying that this group is considered the weakest group in terms of using CT. For instance, G5N4 wrote,

> there exist similarities between these two generations. The way they regard education is quite parallel. This is the point where both generation agrees with each other and achieve their consensus. They encourage me a lot in study... learn as much as I can,…when I look back, the disagreement between them is not necessarily positive or negative

TABLE 7
Analysis of CT for Students in Group 5

CT Indicator	R+	R-	I+	I-	N+	N-	O+	O-	A+	A-	L+	L-	J+	J-	C+	C-	Total
Sub-Total	4	7	0	11	9	2	8	0	4	1	4	2	46	2	21	2	123
% Score	3.25	5.70	0.00	8.94	7.32	1.63	6.50	0.00	3.25	0.80	3.25	1.63	37.40	1.63	17.07	1.63	100
Importance	7[a]	6	N.I.	3	4	10[a]	5	N.I.	7[a]	N.I.	7[a]	10[a]	1	10[a]	2	10[a]	
CT	-0.30		-1.00		0.63		1.00		0.60		0.33		0.92		0.83		

Note. N.I. = Not Important, CT = Critical Thinking
a Shows traits with equal ranks.
Every CT indicator has a positive or a negative representation. CT ratio= (x+- x-) / (x+ + x-) as displays in the last row.

In sum, the analysis indicates that bloggers and non-bloggers applied different CT traits in their discussions. In the next part, we will discuss the resemblance and the difference in CT traits in different groups and how bloggers and non-bloggers' criticalness is affected through the use of different strategies.

RESULTS AND DISCUSSION

The results indicate that different strategies can affect students' CT ability. The following is the result of how different instructions affect bloggers and non-bloggers' criticalness and the extent of CT demonstrated by each group.

The most positive criticalness is seen in Group 2 (92.64%). So "expectation for meaningful feedback" or receiving comments (Chen and

Bonk, 2008, p. 55) has a positive effect on their thinking. What is surprising is that bloggers' comments were not limited to assigned groups; other groups like Group 1 who were not required to give comments to others, joined in the debate by posting their views for their groupmates. This shows that weblogs can create a social cooperative learning environment. Although analysing comments is beyond the scope of this study, we can conclude when students used weblogs for posting and giving comments, the assessment load will be considerably decreased for instructors (Chen & Bonk, 2008). Also, giving comments to others' work not only enhance students' competition, but encouraging them to learn from others and assess other bloggers' performance (Woo & Wang, 2008).

The second highest positive criticalness is detected in Group 1 (88.40%); bloggers used good justification in their arguments. Also, it is shown that high positive criticalness could wane off their total negative criticalness (11.60%) which is detected in some ambiguous, irrelevant and repeated statements as well as new suggestions without giving proofs or justification.

The third highest positive criticalness is detected in Group 3. Statistically in applying criticalness, they appeared like Group 1. This resemblance is given by their close positive criticalness (85.70% versus 88.40%) and negative criticalness (14.30% versus 11.60%) in which the first figure in the brackets shows total CT ratio in Group 3, and the second one presents the same for Group 1. This may imply that both groups used similar thinking patterns in their arguments. One unanticipated finding is that although bloggers in Group 3 shared their ideas about the generation gap in great depth and used a series of postings built up on one another before putting up their writing on the Web, still bloggers in group 1 with no extra influence applied more CT in their posts.

In addition, the result from group 4 shows positive criticalness decreased to 80.50% which is the least positive criticalness among all bloggers' groups. Though in this group bloggers did not achieve high positive criticalness in their first posts, producing another post after receiving comments played a significant role in promoting their CT. It seems plausible to say comments

have a positive effect on waning off ambiguity, creating new ideas for discussion, justifying judgment and providing examples in bloggers' second postings.

As for Group 5, the lowest positive criticalness is detected. This is seen from the lowest percentage of positive criticalness (78.05%). Unlike other groups, a high percentage of negative criticalness (8.94%) is detected in I- as the three high top CT traits, meaning that non-bloggers applied more trivial and unimportant statements in their argument. An implication of this is possibly that weblogging has been heralded as an opportunity to impact students' CT. In other words, blog writing is more effective in promoting CT particularly if bloggers receive their group members' comments than a traditional written page submitted directly to the instructor without any feedback. In conclusion, it seems plausible to say that the presence of groupmates' comments give bloggers a chance to do the most critical evaluation themselves "to bring their work in line with the standards of the community" instead of receiving "a recipe for improvement" from the instructor (Hurlburt, 2008, p. 7). Moreover, this finding supports the idea that weblogs as a tool can help students think in a critical and comprehensive way (Chen & Bonk, 2008).

Another issue that emerges from these findings is that, two indicators of Newman's et al. (1996) model, namely practical utility (P) and width of understanding (W), were not used in analysing the data. This result seems to be consistent with Woo and Wang's (2009) findings in applying the same model to examine students' CT development. Since these two indicators are related to discussing and suggesting solutions, they may seem irrelevant to the nature of the topic selected in the aforementioned studies.

Further Research

To investigate the extent to which weblogs can promote students' CT in an online discussion, purely quantitative research may not be sufficient. Qualitative research such as interviewing is recommended to provide

additional evidence on bloggers' interpretation on the design and implementation of the research.

Also, it is interesting to note that justification (J+) is detected as the first top trait by both bloggers and non-bloggers. This indicates that most students were able to apply a lot of examples and solutions in justifying the generation gap. Hence, a further study is suggested to give more focus on the effect of topics in determining different traits based on Newman's et al. 's (1996) model.

Besides, based on this model, bloggers produced more CT patterns in replying to short posts. In other words, evaluation and justification were used more in their replies to one message ideas, and this is an area that warrants further research.

Further work needs to be done to encourage students' uptake of weblogs in a threaded discussion, in which one blogger responds directly to a message, and another one responds to a response, and thus a discussion thread is created.

Another point to highlight is that students' comments played a crucial role in students' interaction, and producing another posting may cause an influence in promoting bloggers' CT. This research is currently underway and the data collected are encouraging.

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APPENDIX
Newman, Webb and Cocharane's Critical Thinking Model 1996

Category	Positive Indicator	Negative Indicator
R± Relevance	R+ Relevant statements	R- Irrelevant statements, diversions
l± Importance	I+ Important points/issues	I- Unimportant, trivial points/ issues
N± Novelty; new info, ideas, solutions	NP + New problem- related information NI+ New ideas for discussion NS+ New solutions t0problems NQ+ Welcoming new ideas NL+ Learner brings new things in	NP- Repeating what has been said NI- False or trivial leads NS- Accepting first offered solution NQ- Squashing, putting down new ideas NE- Dragged in by tutor
O± Bringing outside knowledge or experience to bear on problem	OE+ Drawing on personal OC+ Refer to course material OM+ Use relevant outside material OK+ Using previous knowledge OP+ Course related problems brought in (e.g., students identify problems from lectures and texts) OQ+ Welcoming outside knowledge	OQ- Squashing attempts to bring experience in outside knowledge O- Sticking to prejudice or assumptions
A± Ambiguities: clarified or confused	AC+ Clear, unambiguous statements A+ Clear up ambiguities	AC- Confused statements A- Continue to ignore ambiguities
L± Linking ideas, interpretation	L+ Linking facts, ideas and notions L+ Generating new data from information collected	L- Repeating information without making inferences or offering an interpretation L- Stating that one shares the ideas or opinions stated, without taking these further or adding any personal comments.

J± Justification	JP+ Providing proof or examples	JP- Irrelevant or obscuring questions or examples
	JS+ Justifying solutions or judgments	JS- Offering judgments or solutions without explanations or justification
	JS+ Discussing advantages and disadvantages of solution	JS- Offering several solutions without suggesting which is the most appropriate.
C± Critical assessment	C+ Critical assessment or evaluation of own or others' contributions	C- Uncritical acceptance or unreasoned rejection
	CT+ Tutor prompts for critical evaluation	CT- Tutor uncritically accepts
P± Practical utility (grounding)	P+ Relate possible solutions to familiar situations	P- Discuss in a vacuum (treat as if on Mars)
	P+ Discuss practical utility of new ideas	P- Suggest impractical solutions
W± Width of understanding (complete picture)	W+ Widen discussion (problem, within a larger perspective. Intervention strategies within a wider framework.)	W- Narrow discussion. (Address bits or fragments of situation. Suggested glib, partial, invention)

(Extracted from Newman et al., 1996)