

INTEGRATING WEBLOGS IN A PEDAGOGY MODEL FOR ENHANCING STUDENTS' CRITICAL THINKING SKILLS

KAI-MING LI

Department of Mathematics and Information Technology

Hong Kong Institute of Education, Hong Kong

kml@ied.edu.hk

Abstract: This study uses quantitative method to examine whether or not a social constructivist theory-driven pedagogical model integrated with weblogs is associated with improved critical thinking skills. Forty secondary 2 students at the age of 13 completed a series of extra-curricular activities designed according to a proposed model within ten months. Half of these students came from high ability class while the other from general ability one. The learning tasks of a topic included practice on thinking skills, written essay on a social issue, and visit to an expert or fieldtrip relevant to the learning topic as well as reflection on the learning experiences. One group of these students submitted their writing tasks in paper form (Paper Group) while the other in weblog entries. (Weblog Group). They also completed a pre-test and a post-test of the Critical Thinking Test – Level 1 (CTT-1) prior to and upon completion of all learning activities, respectively. The analysis revealed that both groups demonstrated gains in Critical Thinking scores in the post-test. Moreover, a significant gain was observed in the Weblog group as well as in the class of general

ability. No significant gender difference was detected. This study also supplemented with qualitative data to solicit opinions from the teachers who assisted in the implementation of the project. Suggestions for improvement were also made at the end.

Keywords: Critical Thinking Skill, Weblog and Learning, Technology and Pedagogy, Information and Communication Technology, Information Technology in Education

1. Introduction

Contemporary educational standards place great emphasis on empowering students to live in and to cope with the fast changing world. The guiding principles include teaching students how to manage their own learning processes, catering to students' needs and interests, and nurturing them into independent learners and critical thinkers who can make wise judgements and solve problems in this highly competitive and information-rich society (Martin, 2003). Hence, developing students' critical thinking skills is as important as helping them master knowledge on different content areas in education as perceived by most government leaders across the world. To achieve this goal, traditional knowledge-focused and teacher-directed modes of education are criticized to be ineffective, thereby necessitating a paradigm shift to a more competency-based and student-centred approach of learning (CDC, 2001). The new learning approach should place emphasis on students' active involvement in an authentic situation as well as their responsibility to articulate their understanding of and

thoughts about their learning experiences. Such an approach should also facilitate the development of critical thinking skills like comparing, classifying, inducing, making deductions, analyzing errors, constructing support, and abstraction (Marzano, 1992). It is a widespread belief that Information and Communication Technologies (ICTs) have a major role to play in promoting such paradigm shift and facilitating the new learning approach (Campoy, 1992). There is also evidence of positive impact on students' attainment in subjects as well as attitudes and cognitive skills in learning with the use of ICTs (Balanskat, Blamire & Kefala, 2006; Jonassen, 1996). In this regard, the Government of Hong Kong Special Administrative Region has documented the above vision concerning the use of ICTs for empowering learning in relevant policy papers (EMB, 1998; EMB, 2004; EDB, 2008). During the last decade, a great deal of resources has already been allotted for the implementation of the aforesaid policy documents. Some evaluation studies have also been conducted to examine the effectiveness and progress of the use of ICTs in education. The latest findings of these studies show that there is a great improvement in the provision of ICTs infrastructure and computing facilities in Hong Kong. Today, the average student to computer ratio is 6:1. All the schools are equipped with broadband connection to the Internet and an average of 74% of them has an additional school wireless network. The findings also revealed an increased use of computing technologies in learning and teaching activities. However, such use is usually confined to teachers' presentation in the class and students' access to prescribed digital resources or information about the learning of subject knowledge. The use of ICT as a tool to develop students' critical thinking skills in student-centred activities is still uncommon (EDB, 2007a; IEA, 2006). It was also reported in another similar study that our students had demonstrated a relatively weak level of higher-order thinking skills while their Information Literacy competence was assessed (EDB,

2007b). The findings of the above studies showed that the ultimate vision laid down in those policy documents has not been achieved yet. Hence, the goal of this research is to develop a pedagogy model with empirical evidence to show how ICTs (especially weblog) can be used to enhance critical thinking skills in student-centred learning activities. The result of this study will serve as an exemplar for the school teachers and will also enrich the pedagogical knowledge on teaching with ICTs.

In a student-centred learning process, greater students' participation and independence are required. However, students may encounter problems and difficulties during the learning process due to their lack of relevant skills and past knowledge. Hence, teacher's role to provide guidance, resources, and support to the students during such learning process is deemed an important factor to students' positive learning outcomes. Moreover, the advancement of Web-based technologies as demonstrated by weblogs in recent times enables a more interactive role of a user as he/she can write essays, respond to others' messages, and share multimedia materials with his/her friends. With this interactive platform, it is anticipated that a weblog can provide stronger scaffolds to learners and thus enhance learning. Therefore, driven by the social constructivist learning theory, a pedagogy model integrating the use of weblogs was developed and tested in this study in order to determine its effect on the development of students' critical thinking skills.

2. Research Background

The research framework of this study is based on the concept of critical thinking and the social constructivist learning theory.

2.1. Technology and Critical Thinking Skill

Watson and Glaser (1980) defined a critical thinker as a person who possesses positive attitudes of inquiry, the ability to identify problems, as well as the knowledge and ability to make inferences, abstractions, and generalizations. The American Philosophical Association (1990) characterized a critical thinker as one who can make purposeful and self-regulatory judgements that help him/her to solve problems and decide on what actions are made involving skills in interpretation, analysis, evaluation, inference, explanation, and self-regulation. Facione, Facione, and Giancarlo (1998) described critical thinking skills as competencies in analysis, evaluation, inference, and deduction. For measuring critical thinking skills, Ennis (1987) proposed a Taxonomy of Critical Thinking Skills that includes elementary clarification, basic support, inference, advanced clarification, and strategies and tactics. Based on Ennis' s framework, Yip (2003) developed an instrument (see Section 3) in Chinese with five sub-scales: recognition of assumptions, deduction, induction, interpretations, and evaluation of arguments. It aims to test the critical thinking capability of primary 5 to secondary 3 students¹.

There have been findings about the favourable effect on learning in which technology-based tools were applied. For example, a review conducted by Santavenere

(2003) showed that technology leads to the positive development of higher-order thinking and problem-solving skills and has a positive impact on many areas in learning, including critical thinking skills. Glogoff (2005), in his study on educational applications of weblogs, revealed their conducive effect on the promotion of interactivity in learner-centred activities as well as the enhancement in students' comprehension of a subject. Meanwhile, in her study, Oravec (2002) concluded that weblogs can be used in classrooms to enhance literacy and critical thinking skills. Similar findings from Richardson's (2004) work also suggested that weblogs have great value in the development of critical thinking skills, writing skills, and information literacy.

2.2. *Weblog and Social Constructivist Learning Theory*

Two important characteristics of the social constructivist view of learning are that the learner is an active agent in constructing his/her own knowledge, and that social interaction is important in this process (Brown & Palincsar, 1989). It also suggests that the learning process is context bound and is dependent on the situation in which the learner is a member (CGTV, 1991). Hence, knowledge is derived from the context in which the learning takes place, particularly from interaction with others (Greeno, Collins & Resnick, 1996). Learning is therefore a social activity in which knowledge is actively internalized through conversation and interaction between the learner and a more

¹ Since 2007, a new Senior Secondary School curriculum has been implemented in Hong Kong. The new system allows our students to receive education for 12 years from primary 1 to 6 and

knowledgeable other (Vygotsky, 1978). Salomon and Perkins (1998) even extended the concept of social interaction in terms of cultural scaffolding in which the individual learner constructs meaning using cultural artefacts rather than by interacting with other knowledgeable persons. These artefacts may be in the form of information sources such as books, videos, articles, or other resource materials. They may also be technology tools used for handling information and for communication such as calculators and computers.

A weblog is more than a Web page delivering information and links to other Internet sources. It is also a social media that encourages a more interactive role for the Web user. With these features, a weblog is an excellent platform that allows users to read information, express thoughts and feelings, react on others' works, and solicit comments or suggestions from others while solving a problem. Hence, with a structural guidance like the WebQuest model (Dodge, 1997) and the social communication tools in a weblog, it is argued that through the inquiry process assisted by carefully designed tasks, Internet resources, and interaction with others, students can construct knowledge by themselves and develop critical thinking skills more effectively.

2.3. The Pedagogy Model

While the WebQuest model and weblog tools may facilitate the development of critical thinking skills, many studies show that success relies heavily on whether the

learners are given the opportunity to practice their cognitive skills to solve problems in an authentic context and if they are given the chance to reflect on these experiences in the learning process (Oravec, 2002; Richardson, 2004; Rozema, 2001). Furthermore, research shows that critical thinking skills can be learned through instruction. For example, Cotton (1991) conducted a meta-analysis on 56 studies and concluded that asking higher-order thinking questions and providing reinforcement are effective approaches to promote critical thinking skills. Such a notion also inspires the development of the pedagogy model used in this study. Hence, the major components of this model resemble those in WebQuest including the following: (1) *Introduction* that creates the context for learning, (2) *Task* in the form of an essay that requires critical thinking skills, (3) *Process* in which written guidance and Internet resources are provided, (4) *Evaluation* that provides clear information of how the learning outcomes are measured, and (5) *Conclusion* that leads the learners to make critical reflection about the learning (see Figure 1).

The figure displays two screenshots of a webquest titled "I Love Blue Sky 我愛藍天".

The left screenshot shows the "6 相片分享" (6 Photo Sharing) section. It features a sidebar menu with the following items: 1 簡介 (Introduction), 2 思考技能 (Thinking Skills), 3 網站探索 (Website Exploration), 4 參加活動 (Participate in Activities), 5 完成任務 (Complete Tasks), 6 回應及分享 (Respond and Share), 7 教育發展平台 (Education Development Platform), 8 課程評議等 - 藍天行動 (Course Evaluation etc. - Blue Sky Action), and 9 思考技能系列 (Thinking Skills Series). A callout box labeled "The five components of the Weblog" points to the sidebar menu. The main content area includes a "題(1)" (Question 1) section with a sentence: "「停車熄匙」新法例可以減少空氣污染嗎?" and a task: "思考：從這句子的中心對空氣污染有甚麼影響?"

The right screenshot shows the "其他意見" (Other Opinions) section. It features a callout box labeled "Reflection on a visit / fieldtrip" pointing to the main content area. The main content area includes a "6 別迴響" (6 Don't Respond) section with a sentence: "這個活動十分有意義!在粉嶺環境資源中心..." and a task: "思考：從這句子的中心對空氣污染有甚麼影響?"

Figure 1. Examples of Weblogs in this study

The model in this study differs from WebQuest model in the media that holds the information (i.e., a weblog instead of a Web page) and the *Process* component. This component consists of three major activities. First is *Learn the Thinking Skill*, where the students are asked to answer a series of questions designed according to Yip's (2003) framework of critical thinking skills. For example, in a topic "I Love the Blue Sky," one of the thinking tasks is as follows:

Proposition: To reduce air pollution means that we can see the blue sky again.

Question: What is the hypothesis about air pollution in the mind of the person who raises this proposition? (See Figure 2)

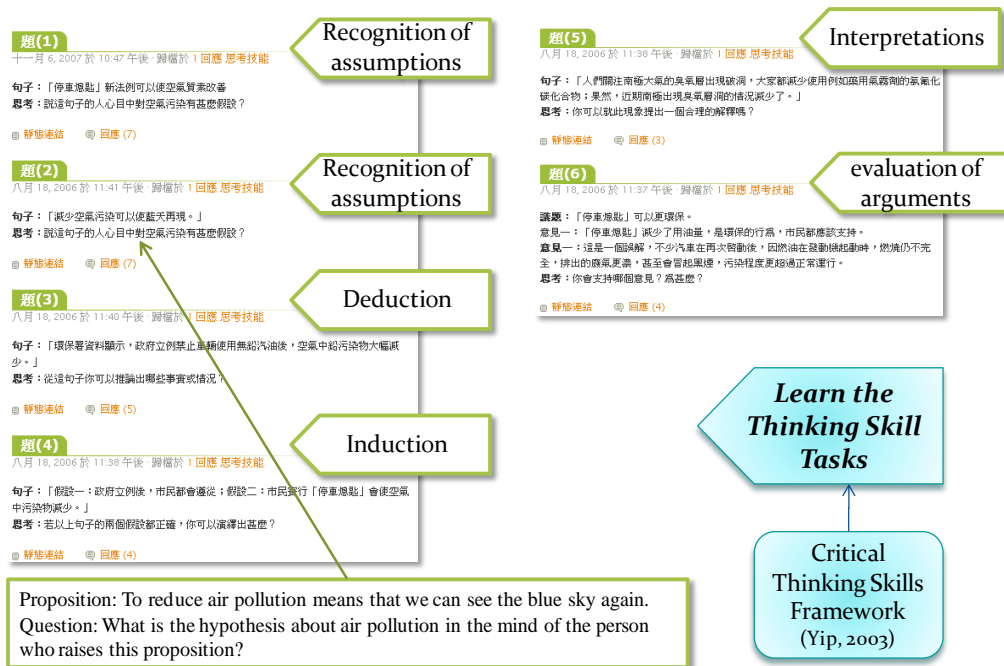


Figure 2. Example of the “Learn the Thinking Skill” Tasks

Students are encouraged to express their views and discuss among other members in a weblog, after that they can submit their answers either in traditional hard copy or as a weblog entry. Second, in *Explore the Internet Resources*, the students are given links to the Internet resources and brief descriptions of these links that are relevant to the task. Finally, in *Visit the Relevant Experts*, the students are expected to take part in an authentic visit or outdoor activity in which they will have the opportunity to meet with experts relevant to the task. Figure 3 shows the framework of the pedagogy model of this study. All the learning activities are designed according to this model.

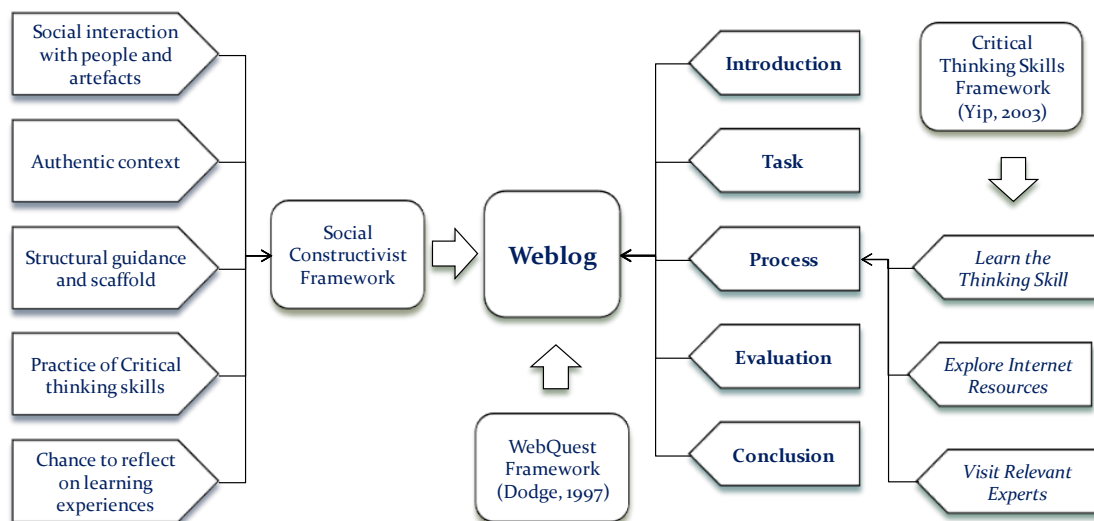


Figure 3. The Pedagogy Model of this Study

2.4. *Aim and research questions*

The aim of this research is to examine the effect of the aforesaid pedagogy model on the development of critical thinking skills among a group of junior secondary school students who participated in a series of student-centred learning activities. It is anticipated that better critical thinking skills are observed among the students who have gone through all the components of the model. It is also expected that higher critical thinking scores are achieved by those students who are assisted by weblog (Weblog Group) compared with those of the other group (Paper Group).

Hence the following research questions are addressed in this study:

- (1) Will there be any changes in the critical thinking skills of the participants who have undergone the learning process informed by the pedagogy model of this study?
- (2) Will there be any differences in such changes among the participants choosing different learning approaches, coming from different ability classes, and of different genders?

It is argued that the learning strategy is crucial in developing students' critical thinking skills, and thus the development and implementation of a learning strategy that best promotes these skills is an important role of school leaders in the 21st century. With this, the results of this research are expected to help enhance knowledge of pedagogy on the development of critical thinking skills in the education community.

3. Methods

At the beginning of this study, a total of 40 secondary 2 students from two schools were invited to take part in the project on a voluntary basis. The two schools are located in the same geographical area where students mainly come from families of low to middle economic classes. Although these schools were convenient samples, they have similar class structures with students coming from similar family backgrounds. In these schools, class A is reserved for the students with higher academic achievement in schools. In the study, 20 participants came from the high ability class (2A), while the others came from ordinary ability class (2B). Six of them were male and thirty-four were female. Two teachers (one of them is male while the other is female) were also invited to assist in the implementation of the project on a voluntary basis. Their major role was to coordinate and lead the learning activities that were designed by the researcher according to the aforesaid pedagogy model. They also provided assistance in preparing learning materials as well as giving feedback to students' completed tasks.

Given that participation in the learning activities was on voluntary basis, the participants were allowed to choose to submit their writing tasks either in paper form (Paper Group) or in weblog entries (Weblog Group). The students of the Paper Group received instructions from the teachers and were assisted with a study guide. Meanwhile, the students of the Weblog Group also received instructions from the teachers in the class and a study guide, but they were at the same time guided with the use of a weblog. The students from this group had the chance to receive immediate comments on their tasks (the thinking skill questions, essay after visiting relevant

experts or fieldtrips and reflection on learning) from the researchers and teachers (see Figure 4) as well as to communicate with other students via the weblog.

I Love Blue Sky 我愛藍天

類(1)
十一月 6, 2007 於 10:47 午後 · 歸檔於 1 回應 · 思考技能

句子：「停車熄匙」新法例可以使空氣質素改善
思考：說這句子的人心目中對空氣污染有甚麼假設？

靜態連結

7 則迴響 >>

edporghk37 說
十一月 14, 2007 @ 7:08 午後

The person who said this sentence thought Air Pollution is cause by there is not any law to restrict it.
(3cquest回應: 這是上述句子的另一個說法, 不是他心中的假設, 且從邏輯上考慮新句子也未必成立)

edporghk07 說
十一月 16, 2007 @ 8:06 午後

說這句子的人心目中是認為香港的空氣污染很差, 而且汽車對香港的大的影響, 汽車的引擎會排出大量廢氣, 使香港的空氣污染更為嚴重。
(3CQuest回應: 基本同意, 但第一句似乎多了些主觀想法。)

edporghk04 說
十一月 17, 2007 @ 3:22 午後

空氣污染在香港的污染很大, 停車熄匙有助改善香港的空氣污染問題。

Responses to the
“Learn the Thinking
Skill” Questions

Figure 4. Example of responses from researcher on thinking skill questions

Finally, 12 of participants chose the Weblog approach (Weblog Group), while 28 opted for the other (Paper Group) (see Table 1).

Table 1

Participants of this study

		Learning Methods		Total
		Weblog Group	Paper Group	
Class	2A	7	13	20
	2B	5	15	20
Total		12	28	40
Gender	Male	3	3	6
	Female	9	25	34
Total		12	28	40

The students participated in a series of six extra-curricular activities within a period of ten months. The topics of each activity were related to controversial social issues. Based on the pedagogy model of this study, the students were required to go through a series of learning tasks including (1) an essay about the topic, (2) an exercise on thinking skills, (3) readings on relevant Internet resources, (4) a visit or a field trip, and (5) a short reflective statement on the learning obtained. They were also given a score on their writing task according to an evaluation rubric that was included in the study guide.

In order to obtain a standard measure of the critical thinking skills among the participants for further analysis, a paper-based Critical Thinking Test – Level 1 (CTT-1) was administered to the participants in the introduction session before the commencement and in the debriefing session after the completion of all learning activities. The instrument is a validated test written in Chinese for primary 5 to secondary 3 students. It contains five sub-scales contributing to the score for critical

thinking in five dimensions: recognition of assumptions, deduction, induction, interpretations, and evaluation of arguments. Each sub-scale consists of one example and its explanation and is followed by five multiple choice questions leading to a total of 25 questions in the test. One point is given to each correct choice with reference to a standard answer sheet. The maximum score is 25. The overall reliability of the instrument is 0.76 (Yip, 2003).

In answering the research questions stated in Section 2, the following null hypotheses were tested using the computer software Statistical Package for Social Sciences (SPSS):

- (1) There is no significant difference in the CTT-1 scores before and after the learning activities among the participants.
- (2) There is no significant difference in the CTT-1 scores after the learning activities among the participants in different learning groups, from different ability classes, and of different genders.
- (3) There is no interaction between different learning groups and ability classes as well as genders on the CTT-1 scores after the learning activities

The CTT-1 scores of both the pre-test and post-test were checked with the normality and equality of variances before the inferential testing. The result of the K-S test (D) of normality showed that the CTT-1 scores were not significantly different from a normal distribution for both pre-test and post-test [$D_{(40)} = 0.092$, $p > 0.05$ and $D_{(40)} = 0.092$, $p > 0.05$ respectively]. The Levene's test (F) of equality of variances also showed that there was no significant difference in the variances among the data from the students between the two schools [$F_{(1, 38)} = 3.727$, $p > 0.05$ and $F_{(1, 38)} = .000$, $p >$

0.05 in the pre-test and post-test, respectively]. Given the above findings, Paired Samples T Test was adopted to test the significance of Hypothesis 1, while 2-ways ANOVA was used to test the significance of Hypothesis 2 and 3. The effect sizes (Cohen' s d for t-test and Cohen' s f for ANOVA) (Kotrlik & Williams, 2003) were also reported to show the magnitude of impact.

Post-project interviews were also conducted to solicit opinions from the teachers regarding the implementation of the project and suggestions for improvement. The following main questions were asked:

What were the main concerns and hurdles in the implementation of the project?

What were the conducive factors that facilitate the implementation of the project?

4. Results

The following sections present the findings of the inferential tests on the hypotheses and the post-project interviews as stated in section 3.

4.1.1. Gains in CTT-1 Scores by Different Learning Methods

The result of the Paired Samples T-Test for all the participants showed that a significant increase was observed in the CTT-1 post-test mean score with a medium

effect [$t_{(39)} = 2.611, p < 0.05, d = 0.395$]. A further attempt to examine such an effect on the participants who chose different learning approaches revealed that only those in the Weblog group obtained a significant increase in the CCT-1 score with a strong effect [$t_{(11)} = 3.334, p < 0.05, d = 0.918$]. There was no significant gain in the Paper group [$t_{(27)} = 1.05, p > 0.05$] (see Table 2). The findings indicated that the pedagogy model of this study might have a positive effect on the enhancement of critical thinking skills and that the effect might be more substantial for those participants choosing the weblog approach than the paper one.

Table 2

CCT-1 mean scores differences between pre-test and post-test

Factor	CCT-1 Test	Mean	N	S.D.	S.E.	Mean Difference	t [#]	df	Sig. (2-tailed)	Cohen's d [@]
Overall	Post-test	18.28	40	3.18	0.50	1.35	2.611	39	0.013*	0.395
	Pre-test	16.93	40	3.63	0.57					
Learning Method										
Weblog	Post-test	19.58	12	3.15	0.91	3.08	3.334	11	0.007*	0.918
	Pre-test	16.50	12	3.55	1.03					
Paper	Post-test	17.71	28	3.08	0.58	0.60	1.05	27	0.303	0.176
	Pre-test	17.11	28	3.71	0.70					

[#]Paired Samples T-Test; * $p < 0.05$; [@]Effect Size

4.1.2. Effect of different learning methods, abilities and gender of the participants on CTT-1 scores

The result of the 2-ways ANOVA showed that at a significant level of 0.05, there were no significant differences in the CTT-1 post-test mean scores among the participants who chose to learn with the weblog or paper approaches [$F_{(1, 36)} = 3.112$, $p > 0.05$]. However, if the significance level was set at 0.1, the difference became significant with a medium effect [$F_{(1, 36)} = 3.112$, $p < 0.1$, $f = 0.295$], and such result became close to the conclusion made in Section 4.1.1. The choice of different learning methods did have a medium effect on critical thinking skill with particular impact from the Weblog group (see Table 3). It is also shown from the table that there was no interaction between the two factors (Ability Class and Learning Method) [$F_{(1, 36)} = 2.222$, $p > 0.05$].

Table 3

Effects of different learning methods and ability classes on CTT-1 Post-test scores

Source of Variation	Sum of Squares	df	Mean Square	F [#]	P-value	Cohen' s f [@]
Ability Class	5.842	1	5.842	0.651	0.425	0.135
Learning Method	27.926	1	27.926	3.112	0.086*	0.295

Interaction	19.938	1	19.938	2.222	0.145	0.248
Within	323.029	36	8.973			
Total	13753.000	39				

#2-ways ANOVA; *p < 0.1; @Effect Size

The finding in Table 3 indicates that no significant differences in the CTT-1 post-test mean scores were observed among the participants from different ability classes [$F_{(1,36)} = 0.651, p > 0.05$]. However, before the implementation of the pedagogy model, a significantly higher mean score in the pre-test was observed among the participants in the high ability class (2A) [$F_{(1,36)} = 7.618, p < 0.05, f = 0.461$].

The study showed that the original class difference in the pre-test mean score (18.7 for 2A and 15.15 for 2B) might have been minimized in the post-test one as a result of the pedagogy model. It might also be concluded that the pedagogy model developed in this study was particularly effective for the general ability class (2B). Such conclusion was also supported by the finding of the Paired Samples T Test on the CTT-1 pre-test and post-test scores in 2B when Ability Class was treated as the testing factor [$t_{(19)} = 3.437, p < 0.05, d = 0.726$] (see Table 4).

Table 4

CTT-1 mean scores differences between pre-test and post-test

Factor	CTT-1	Mean	N	S.D.	S.E.	Mean	t [#]	df	Sig.	Cohen'
	Test					Difference			(2-tailed)	s d [@]

2A	Post-test	19.10	20	2.845	0.636	0.4	0.573	19	0.597	0.128
	Pre-test	18.70	20	3.389	0.758					
2B	Post-test	17.45	20	3.348	0.749	2.3	3.437	19	0.003*	0.726
	Pre-test	15.15	20	2.978	0.666					

#Paired Samples T-Test; *p < 0.05; @Effect Size

The study illustrated that all participants in this study were benefited by the proposed pedagogy model for enhancing critical thinking skills. This positive effect was particularly obvious for the participants who chose the Weblog mode during the learning process. The difference in CTT-1 scores between the high ability and the general ability classes was also reduced as a result of the learning model.

Regarding the effect of gender of the participants on the CTT-1 scores upon completion of the learning project, significant difference was not detected [$F_{(1, 36)} = 1.034$, $p > 0.05$]. There was no interaction between different genders and learning methods as well [$F_{(1, 36)} = 0.000$, $p > 0.05$].

4.1.3. *Opinions from the teachers*

When the teachers were asked about the main concerns and hurdles that they had encountered during the implementation of the project in a post-project interview, one of them said that the need of a culture in using text for discussion in a weblog was one of

the main concerns in the implementation of the project: “To express ones’ idea simply in text form is a new attempt and is difficult for a secondary 2 student”. The other teacher expressed that the lack of background knowledge of the selected topics was the other hurdle for smooth running of the project. She expressed that without the knowledge of a particular issue, students could hardly respond to the questions that demanded high-level thinking skills. Hence, a reading session in the class should have been included before the commencement of other tasks in each learning activity. Despite the above, the teachers did identify some conducive factors that had facilitated the implementation of the project. It was found that students’ motivation and interest in the selected topics were increased after taking part in authentic visits or outdoor activities like the Court Visit. The other main factor was the timely feedback and comments made on the work done by the students in each learning activity. Both teachers regarded the above factors as the major incentives to encourage the students to stay along in the project for such a long period of time (10 months). The next successful element goes to the pedagogy model integrated with the use of weblogs as one of the teachers had stated during the interview:

“The weblogs provide clear guidelines and useful resources for informal learning in the form of extra-curricular activities like those in this project. Students could work on the tasks independently at their spare time and reflect on the feedback from the researcher”.

However, both teachers expressed that in order to sustain such pedagogy, the support from school principal and the need of a personnel who is an expert in designing the learning activities according to the proposed model as well as financial assistance for conducting outdoor activities are deemed to be important in the long run.

5. Discussion and Conclusion

Echoing the need for critical thinkers in the workforce of the 21st century, the findings of this study may add value to the existing practice in developing students' critical thinking skills using the latest Internet technology. In this study, an integrated pedagogy model informed by the social constructivist learning theory and the ideas of WebQuest was developed and was proven to be effective in enhancing critical thinking skills, particularly in the Weblog group.

Even though the result of this study was positive, apparent limitations that could impede its to normal school settings were observed. First, the students were chosen by convenient sampling method due to the fact that performing true experimental research is hardly feasible under normal circumstance in the classroom settings. Second, students' participation in the extra-curricular activities and their choice of types of interaction (Paper group and Weblog group) were totally on voluntary basis in this study. Such condition has also posed difficulty in controlling the equivalence of some independent variables, such as the gender of the participated students and the learning method they adopted in this case. Hence, the result of this study might only be applicable to those students who possessed particular characteristics that are left for further investigation.

Despite the above limitations, the result of this study helps to further validate the findings in similar studies regarding the enhancement of critical thinking skills with the

use of technology (e.g. Glogoff, 2005; Oravec, 2002; Richardson, 2004; Santavenera, 2003). It also has enriched the knowledge base in the integration of technology into learning with an evidence-based pedagogy model in which essential elements were identified: (1) a social constructivist learning theory-driven instructional design that is transformed as a systemic written plan either given in the form of guide sheet or in a weblog to scaffold the learning process, (2) the opportunities to practice and apply thinking skills in learning tasks, as well as to make reflection on their authentic learning experiences, (3) an interactive platform like a weblog to express feelings and thoughts as a form of interaction with other more knowledgeable persons, as well as to search for appropriate resources for problem solving, (4) visits or field trips to obtain first-hand experiences and to meet experts relevant to the chosen topics, and (5) timely and immediate feedback from the facilitator. Furthermore, the overall success of the model depends greatly on the careful design of the tasks and activities, the support and resources for the administration of the weblogs, and the implementation of the plans. Hence, dissemination of the pedagogy model through staff development programmes for the school teachers as well as the school administrators is crucial. It is not until the school administrators who believe the rationale of the design of such learning model, and the school teachers who are willing to change their practice of teaching, that more students will benefit. It is also expected that a culture of blending the use of technologies in learning should be established at the early stage of learning such as during primary education. Providing timely feedback and comments to the students is also important as it allows students to reflect on their learning experiences and to refine their thinking skills. The use of weblogs in this project is believed to be effective in achieving the above vision. Furthermore, the effort made to maintain the students' motivation and desire for participation in the weblog is also a crucial factor for the

overall success of the model and it is an important issue that must be addressed in most blogging activities in learning (Downes, 2004). It is suggested that the incorporation of outdoor activities, provision of feedback on the completed tasks to the students from expert and the construction of a vivid and user-friendly interface in the weblogs are the effective measures to maintain the incentive of the students in participating in relevant learning activities.

Acknowledgment

The author would like to thank the students for their participation in the study. His gratitude is also extended to teachers K. L. Wu and O. S. Yip for their help. Finally, he expresses his sincere appreciation to Dr. Y.S. Lam, the chairman of the former Education Development Platform, a non-profit agency, for his wholehearted support and insightful comments on the project.

References

American Philosophical Association (1990). *Critical thinking: a statement of expert consensus for purposes of educational assessment and instruction* . Retrieved 10 October, 2007, from

<http://www.eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED315423>

Balanskat, A., Blamire, R., & Kefala, S. (2006, December). The ICT impact report: A review of studies of ICT impact on schools in Europe. *Insight Report*. Retrieved April 26, from http://www.xplora.org/ww/en/pub/insight/misc/specialreports/impact_study.htm

Brown, A. L., & Palincsar, A. S. (1989). Guided, cooperative learning and individual knowledge acquisition. In L. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser*. Hillsdale, NJ: Erlbaum.

Campoy, R. (1992). The role of technology in school reform movement. *Educational Technology*, 32(8), 17-22.

Cognitive and Technology Group at Vanderbilt (CTGV) (1991). Some thoughts about constructivism and instructional design. *Educational Technology*, 31(9), 16-18.

Cotton, K. (1991). Close-up #11: Teaching thinking skills. *Northwest Regional Educational Laboratory's School Improvement Research Series*. Retrieved 30 April, 2009, from <http://www.nwrel.org/scpd/sirs/6/cu11.html>

Curriculum Development Council (CDC) (2001). *Learning to learn, Life-long Learning and Whole-person Development: The way Forward in Curriculum Development*. Hong Kong: Printing Department.

Dodge, B. (1997). *Some thoughts about webquests*. Retrieved 30 April, 2009, from http://webquest.sdsu.edu/about_webquests.html

Downes, S. (2004). Educational blogging. *Educause Review*, 5, 15-26. Retrieved 30

April, 2009, from <http://net.educause.edu/ir/library/pdf/ERM0450.pdf>

Education and Manpower Bureau (EMB). (1998). *Information Technology for Learning in a New Era: Five-Year Strategy – 1998/99 to 2002/03*. Hong Kong: EMB.

Education and Manpower Bureau (EMB). (2004). *Empowering Learning and Teaching with Information Technology*. Hong Kong: EMB.

Education and Manpower Bureau (EMB) (2005). *Overall Study on Reviewing the Progress and Evaluating the Information Technology in Education (ITEd) Projects 1998/2003 – Final Report*. Hong Kong: EMB.

Education Bureau (EDB) (2007a). *Phase (I) Study on Evaluating the Effectiveness of the ‘Empowering Learning and Teaching with Information Technology’ Strategy (2004/2007) – Final Report*. Hong Kong: EDB.

Education Bureau (EDB) (2007b). *Phase (II) Study on Evaluating the Effectiveness of the ‘Empowering Learning and Teaching with Information Technology’ Strategy (2004/2007) – Final Report*. Hong Kong: EDB.

Ennis, R. H. (1987). A taxonomy of critical thinking dispositions and abilities. In Baron, J. & Sternberg, R. (Eds.), *Teaching thinking skills: Theory and practice*, (pp. 9-26). New York: Freeman.

Facione, P. A., Facione, N. C., & Giancarlo, C. A. (1998). *Professional judgement and disposition toward critical thinking*. CA: California Academic Press.

Glogoff, S. (2005). Instructional blogging: Promoting interactivity, student-centred learning, and peer input. *Innovate 1* (5), n.p. Retrieved 30 April, 2009, from

<http://www.innovateonline.info/index.php?view=article&id=126>

Greeno, J.G., Collins, A. M., & Resnick, L. B. (1996). Cognition and learning. In D. C. Berliner & R. C. Calfee (Eds.), *Handbook of educational psychology* (pp. 15-46). New York: Macmillan Reference.

International Association for the Evaluation of Educational Achievement (2006). SITES 2006 Technical Report. Retrieved November 27, 2009, from http://www.iea.nl/fileadmin/user_upload/docs/SITES2006_TechnicalReport.pdf

Jonassen, D.H. (1996). *Computers in the classroom: Mindtools for critical thinking*. Englewood Cliffs, NJ: Prentice Hall.

Kotrlik, J. W., & Williams, H. A. (2003). The incorporation of effect size in information technology, learning, and performance research. *Information Technology, Learning, and Performance Journal*, 21(1), 1-6.

Martin, A. (2003). Towards e-literacy. In A. Martin & H. Rader (Eds.), *Information and IT literacy: enabling learning in the 21st century* (pp. 3-23). London: Facet Publishing.

Marzano, R. J. (1992). *A different kind of classroom: Teaching with dimensions of learning*. Alexandria VA: Association for Supervision and Curriculum Development.

Oravec, J. A. (2002). Bookmarking the world. Weblog applications in education. *Journal of Adolescent & Adult Literacy*, 45(7), 616-621.

Richardson, W. (2004). Metablognition. *Weblogg-Ed*. Retrieved 30 April, 2009, from <http://weblogg-ed.com/2004/04/27/>

Rozema, R. (2001). "Heart of darkness" WebQuest: Using technology to teach literary criticism. Retrieved 10 October, 2007, from <http://www.eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED458622>

Salomon, G., & Perkins, D. (1998). Individual and social aspects of learning. *Review of Research in Education*, 23, 1-24.

Santavenere, A. (2003). The Effects of Educational Technology upon the Critical Thinking and Analytical Skills of Below Grade-Level and or Non-College Bound High School Students. ERIC Document ED476469. Retrieved 1 March, 2008, from <http://www.eric.ed.gov/ERICWebPortal/recordDetail?accno=ED476469>

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Watson, G. & Glaser, E. M. (1980). *Watson-Glaser Critical Thinking appraisal manual*. USA: The Psychological Corporation.

Yip, Yuk Chu (2003). *Critical Thinking Test – Level 1*. Retrieved 1 April, 2009, from <http://www3.nccu.edu.tw/~ycyeh/instrument-english/2003%20CTT-I%20introduction.pdf>