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英文寫作教學的設計原則：以科技爲媒介的知識建立環境

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本研究之目的在於探究以科技爲媒介的知識建立環境中，有效的與以改革爲導向的一些設計原則，此些設計原則可資提供教師與研究人員使用，以利將一個以英語爲外語的大學教室文化，從一個傳統的教學模式，轉變成爲「知識建立」的社區模式。研究的參與對象爲台灣的一所科技大學應用外語系大二學生共 19 人，其中 4 人爲男性，15 人爲女性，年齡爲 20 至 23 歲，在台灣學習英文約 7 至 10 年。在兩個學期的過程中，研究者使用了三個「設計實驗」的研究方法，以資評估此「知識建立」的社區模式所形成的原因。研究者總共收集了三種資料：(1)知識論壇®中的參與數量；(2)論說文的品質；(3)質性的訪談。研究結果發現學生們的參與數量增加，而論說文寫作品質亦增進。此研究的結論是這些設計實驗有助於將教室文化轉變爲知識建立的社區模式，然而需要更多的時間以充分達成期望的結果。

關鍵字：以英語爲外語、寫作教學、知識建立社區、設計實驗

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1. Introduction

Over the past decades, there have been growing concerns over the appropriateness of traditional education in terms of fostering students' "collective cognitive responsibility for the advancement of knowledge" (Scardamalia, 2002) and in terms of its utility in preparing students for the 21st century. Some researchers have argued that neither teacher-directed knowledge transmission, nor student-centered discovery learning can satisfactorily create the culture for advancing students' collective knowledge, which is required in the knowledge age (see Bereiter, 2002b). What is required, however, is a promising epistemology of the nature of knowledge and learning, new forms of interactivity, and the implementation of reform-oriented educational innovation (e.g., curricular and technological innovation). In other words, there is a need for new cultures of education (Hewitt, 1996).

As defined by Scardamalia and Bereiter (2003), knowledge building is "the production and continual improvement of ideas of value to a community, through means that increase the likelihood that what the community accomplishes will be greater than the sum of individual contributions and part of broader cultural efforts" (p.2). They propose that a knowledge building approach, as it is applied to education, means "engaging learners in the full process of knowledge creation from an early age" (p.2). They go on to argue that in knowledge-building environments, "ideas are treated as real things, as objects of inquiry and improvement in their own right" (p.5). In other words, in knowledge-building environments, ideas and thinking processes are not only preserved, but also made available to the whole community in a forum that allows them to be discussed, revised, commented on, distributed, advanced, and so on.

In this study, the researcher proposes that turning schools into knowledge-building communities and transforming classrooms from a focus on tasks and activities to a focus on knowledge will help prepare students for the 21st century. In these communities, knowledge building is incorporated into the social fabric of the community and into the technologies that support knowledge work (Scardamalia, 2000). The notion of schools functioning as knowledge-building communities rather than traditional and typical service organizations is well elaborated by Bereiter and Scardamalia (1993, 2005), who regard the Knowledge-Building Community model as an alternative to the two traditional instructional models of teacher-directed didactic instruction and student-centered discovery learning (Woodruff et al., 1998). In order for schools to function as knowledge-building communities, Scardamalia and Bereiter (1999) suggest a new discourse medium and computer network technology to provide possibilities for more decentralized forms of discourse. The new discourse medium and computer network technology, they claim, can help reframe classroom discourse and may, in turn, effectively facilitate participants' knowledge-building processes (including positive attitudes, active and constructive involvement/participation, productive electronic discussion and purposeful contribution).

1.1. Research question

One pivotal research question was formulated to guide this study:

What are the design principles of an effective, reform-oriented educational innovation

(e.g., curricular and technological innovation) in a technologically-mediated knowledge building environment that teacher-researchers may employ in order to transform a university EFL classroom culture from a traditional pedagogy model to a knowledge-building community model?

2. Literature review

Teacher educators began to incorporate computer-mediated communication (henceforth CMC) technology into second- and foreign-language teaching in the late 1980s (Matsuda et al., 2003; Warschauer, 1996, 2004, 2006). In addition, a number of researchers started to examine the relationship of technology with second language (L2) writing (Matsuda et al., 2003). Since then, computer use in writing instruction has attracted worldwide attention (Matsuda et al., 2003; Warschauer, 1996, 2004, 2006). Some scholars describe the computer as an educational tool that may facilitate the process of writing and revising, and conclude that the computer can be of value for L2 writers if it is used under certain conditions (Pennington, 1993). However, these are conventional views of computers and L2 writing. In other words, the computer was used primarily as a word processor (Hyland, 2003; Pennington, 1996, 1999). In addition, there has been a significant development in computer networks, which, from a socio-cognitive perspective, allow the computer to be used as a vehicle for interactive human communication (Warschauer & Kern 2000). With the advent of considerable computer use in language and literacy, computer technology continues to have an influence on how we read and write, and how we make use of written language to learn and to communicate with others (Kern, 2000). Computer technology has had a profound impact on literacy practices in L2 classrooms over the last decade, and writing instruction is now making widespread use of computer technologies (Hyland, 2003; Pennington, 2003). As Pennington (2003) notes, the merit of the computer for the L2 writer is significant "for helping to automate the production and revision of text, to encode ideas, and to spark and energize the writing process" (p. 304). It is imperative, then, that writing teachers take an active role in deciding the best ways to make use of computer potentials and to open up new possibilities for our L2 students.

A considerable number of studies have documented important relationships between computer use and students' writing performance. In particular, evidence drawn from two U.S. nation-wide reports suggest that computer use in writing instruction can lead to improved writing performance among grade 4, 8, and 12 students (Greenwald et al., 1999). However, the relationship between CMC technology and students' composing and thinking processes, as well as the questions of how CMC technology interacts with writers, and how a knowledge-building English as a foreign language (EFL) writing environment can be created, have not been given adequate attention. To address these issues, I investigated the impact that knowledge building and computer technology can have within an EFL context involving nineteen Mandarin-speaking writers studying in a university in Taiwan.

Scardamalia (2002) suggests that reforming a traditional work site where students passively complete teacher's assigned tasks into a knowledge-building classroom requires adherence to the knowledge-building principles, a classroom culture that promotes collective responsibility and the support of a technologically-mediated discourse environment.

In this study, *Knowledge Forum* was used to provide the technological support. The focal problem for this research, then, is what the design principles of an effective, reform-oriented educational innovation (e.g., curricular and technological innovation) for EFL writing are that teacher-researchers may employ.

The following sections make frequent reference to *Knowledge Forum*, the conferencing system developed by the Ontario Institute for Studies in Education of the University of Toronto (OISE/UT) and which was used extensively during the two-semester research. Through this CMC technology, participants shared information and resources, and used this as a means to provide collaborative support and a resource for reflective learning. The activities students actually carried out in *Knowledge Forum* primarily involved contributions to the *Knowledge Forum* database, which included creating individual notes, commenting on other students' notes, reflecting on other students' notes, giving feedback on other students' notes, and writing argumentative essays at the end of each stage.

3. Research methods

3.1. Participants

The population was second-year university EFL students. Participants were 19 students of an English writing class. Among the 19 students, 4 were male and 15 female. The ages of the 19 participants ranged from 20 to 23 and they had studied English in Taiwan for 7 to 10 years. They were selected for the following reasons: (a) As second-year university students of the department of applied foreign languages, all needed to take an English writing course, and (b) I was the instructor for this course.

With regard to participants' past experience of English writing, they had taken a general English writing course for one year before they participated in this research. As for participants' previous experience of taking any online course, they had not had such an experience before.

3.2. Design research experiments

To promote change in the classroom culture, the researcher introduced the innovations (i.e., four interventions at stage 1, three interventions at stage 2, four interventions at stage 3, see Appendix A) using design experiments over three stages of the research to engage university EFL students in a knowledge-building community through CMC technology. Each stage is a cycle in the design research paradigm where one cycle of research follows on the findings of the previous cycle in that design experiment is a new research paradigm for reforming education through "design" and "experiments" often conducted in classroom settings, which explore how technological innovation influences students' learning and educational practice (Bell, 1998; Brown, 1992; Hsi, 1998).

Although both design research and action research that is used in second/foreign language education are theoretically based, action research is primarily focused on improving practice (Burns, 1999; Nunan, 1992; Wallace, 1998) while design research is focused on changing practice and then using that information to provide feedback into the theory (Bereiter, 2002a; Schoenfeld, in press).

3.3. Data collection

The research was carried out during two regular 50-minute class periods on a weekly basis for two semesters (approximately seven

months) at a university in Taiwan. The activities students actually performed in a technologically-mediated environment called *Knowledge Forum* (KF) primarily involved contributions to the Web KF database. These included creating individual notes, commenting on other students' notes, reflecting on other students' notes, giving feedback to other students about their notes, writing argumentative essay(s) at the end of each instructional period. The data collection was administered three times, each at the end of three cycles of design experiments. Altogether, three kinds of data were collected as follows in order to help the researcher fine-tune or refine curriculum or software to optimize student interactions: (1) quantity of participation in *Knowledge Forum* (KF); (2) quality of essays; and (3) qualitative, open-ended interviews.

3.4. Data analysis

3.4.1. Analysis of the quantity of notes on Knowledge Forum

In order to verify if there was a general trend towards greater participation both in terms of number of entries to the database and the proportion of the database read (Woodruff et al., 1998), the researcher used descriptive statistics to analyze the total number and the mean number of participation/comments by each student at each stage. The researcher asked a colleague, a Ph.D. student in bilingual education in the U.S. and an experienced rater and teacher of EFL writing, to do a reliability check.

3.4.2. Rating of the essays

In order to verify if there was a general trend towards an improved level of writing quality, the researcher also rated each essay using a scale of zero to six (0 = not ratable: no text feature; 1 = unsatisfactory: 1 text feature; 2 = insufficient: 2 text features; 3 = uneven: 3 text features; 4 = sufficient: 4 text features; 5 = skilled: 5 text features; 6 = excellent: 6 text features) (see Appendix B). Finally, the researcher asked the colleague mentioned above to do a reliability check.

3.4.3. Transcription and coding of interview data

Finally, in order to extend this investigation into students' perceptions, the researcher supplemented the above-mentioned research methods with a qualitative open-ended interview (see Appendix C) involving one-third of the students at the completion of each cycle. The researcher interviewed six participants in the first stage, seven different participants in the second stage, and six different participants in the third stage. The researcher used the interview schedule adopted from Cumming et al. (2002) to solicit information on students' goals for improving their argumentative writing and information on students' feedback to and perceptions about the design experiments in order to help the researcher fine-tune or refine curriculum or software to optimize student interactions and hopefully to create a knowledge-building community. In short, the translations were based on free translation instead of literal translation, because it was not virtually essential to do literal translation of participants' Chinese discourse into English. Transcription conventions were not used in the analysis. When presenting the interview data in English, the researcher quoted the translations at length in order to convey the essential content of each participant's response.

4. Results

4.1. Quantity of participation in the database of Knowledge Forum

For all 19 participants, both reading and writing increased, with a slight decrease in the average number of notes related to their writing. At stage 2, the mean was 54.89, which dropped to 51.53 at stage 3, because discussion quality was more emphasized in stage 3 than in stage 2. The average number of notes written by this group rose from 27.00 at stage 1 to 54.89 at stage 2, and to 51.53 at stage 3. As well, the proportion of CMC read by this group increased from 27% at stage 1 to 42% at stage 2, and to 76% at stage 3, and the percentage of users' notes that were linked rose from 62% at stage 1 to 91% at stage 2, and to 93% at stage 3. The percentage of user's notes with keywords rose from 59% at stage 1 to 71% at stage 2, and to 75% at stage 3. The average number of words per note increased from 74 at stage 1 to 105 at stage 2, and to 129 at stage 3. The average number of topics addressed changed from 9 at stage 1 to 13 at stage 2, but decreased to 5 at stage 3. Similarly, the average number of notes in build-ons increased from 19 at stage 1 to 52 at stage 2, and to 50 at stage 3. Furthermore, the number of co-authored notes/essays rose from 0 at stage 1 to 20 at stage 2, and to 14 at stage 3 (see Table 1). In addition, observational data suggest that participants' average use of scaffold supports increased from 0 at stage 1 to 112.9 at stage 2, to 140.7 at stage 3. In summary, the analysis of this data revealed a general trend during the two semesters towards greater participation both in terms of number of entries to the database and the proportion of the database read. Using Pearson correlation coefficients, the researcher calculated and produced an inter-rater reliability of .98 at stage 1, .96 at stage 2, and .99 at stage 3. The overall reliability between two raters was found to be high: .98 at stage 1, .96 at stage 2, and .99 at stage 3 respectively over the quantity of participation in the database.

4.2. Quality of essays in the database (essays in Knowledge Forum)

For the entire group of 19 students, the overall percentage and overall number of students' essays at the 'skilled' and 'excellent'

Table 1 Involvement/participation rates at three stages

Item / Stage	Number of notes contributed by this group	Average number of notes contributed per user	Percentage of notes that were read per user	Percentage of user's notes that were linked	Percentage of user's notes with keywords
Stage 1	513	27.00	27%	62%	59%
Stage 2	1037	54.89	42%	91%	71%
Stage 3	977	51.53	76%	93%	75%

Item / Stage	Average number of words per note	Average number of topics addressed	Average number of notes in build-ons	Number of co-authored notes/essays	Use of scaffold supports
Stage 1	74	9	19	0	0
Stage 2	105	13	52	20	112.9
Stage 3	129	5	50	14	140.7

levels incrementally increased. The overall percentage at the 'skilled' level rose from 0% at stage 1 to 20% at stage 2, and to 46% at stage 3. The overall percentage at the 'excellent' level increased from 0% at stage 1 to 9% at stage 2, and to 19% at stage 3. And the overall number of students' essays at the 'skilled' level rose from 0 at stage 1 to 3.75 at stage 2, and to 8.67 at stage 3. The overall number of students' essays at the 'excellent' level rose from 0 at stage 1 to 1.75 at stage 2, and to 3.67 at stage 3.

In other words, at stage 1, 0% of students' essays had five or six features in their writing. At stage 2, 20% of students' essays had five features in their writing and 9% of students' essays had six features in their writing. At stage 3, 46% of students' essays had five features in their writing and 19% of students' essays had six features in their writing.

In sum, students demonstrated that their essay-writing quality improved as evidenced by the fact that at stage 3, 46% of the essays were identified as reaching the 'skilled' level, and 19% of the essays were identified as reaching the

Table 2 Quality of students' essays in KF at three stages

Coding category	**Coding value**	**Overall (%)**	**Overall (#)**
not ratable (no feature in text organization)	**0**		
Stage 1		2%	0.5
Stage 2		0%	0
Stage 3		0%	0
Unsatisfactory (1 feature in text organization)	**1**		
Stage 1		0%	0
Stage 2		2%	0.5
Stage 3		0%	0
Insufficient (2 features in text organization)	**2**		
Stage 1		22%	4
Stage 2		15%	2.75
Stage 3		2%	0.33
Uneven (3 features in text organization)	**3**		
Stage 1		42%	8
Stage 2		16%	3
Stage 3		3%	0.67
Sufficient (4 features in text organization)	**4**		
Stage 1		34%	6.5
Stage 2		38%	67.25
Stage 3		30%	5.67
Skilled (5 features)	**5**		
Stage 1		0%	0
Stage 2		20%	3.75
Stage 3		46%	8.67
Excellent (6 features)	**6**		
Stage 1		0%	0
Stage 2		9%	1.75
Stage 3		19%	3.67

'excellent' level (see Table 2). In addition, database analyses revealed a high level of discussion as time progressed, especially at stage 3 in the research. Rather than asking low-level questions (e.g., yes/no questions), participants asked high-level questions. In other words, there was a general trend towards an improved level of writing quality. Using Pearson correlation coefficients, the researcher calculated and produced an inter-rater reliability of .87 at stage 1, .84 at stage 2, and .91 at stage 3. In other words, the overall reliability between two raters was found to be high.

4.3. The results of qualitative, open-ended interview data

It is important to consider a few excerpts and examples of the interview data, particularly as they may be related to discovering the design principles of an effective and reform-oriented educational innovation.

Many participants, it should be pointed out, tended to make a comparison between their previous experiences with writing and this research experience with writing, and they were satisfied with their composing processes.

According to the interview data, all participants had positive feedback to the scoring criteria of the course. Of the 19 participants, 17 expressed, during their interviews, positive reactions to the course outline.

Along with Yii-feng, some other participants, including Yue-seng, Zeng-chia, Chi-weng, Chia-ling, and Zung-shiang, found that online discussion with other classmates was helpful when faced with difficulty in argumentative writing. Chia-ling pointed out:

> I feel that it's easy for me to get immersed in my own writing world; then I don't know how to punctuate sentences, and I will write in Chinese style and continue writing, which may be different from English writing and which may be regarded as redundant and too long. Through online discussion, I can decide my own position and find evidence to support my position, for example, on the topic of "lottery." So I think the interaction in the *Knowledge Forum* is very helpful.

Most participants stated that other people helped them write (see Appendix C, question 7 on collaborative learning). Show-yue indicated:

> Classmates. They told me how to correct my writing in private. In online discussion, we seldom talk about grammar, but we talk about ideas very often. So what they inspire me about during online discussion is the ideas. About improving the English grammar, I think it depends on us students. I think your idea of offering us some references and books is very good.

The majority of the participants viewed computers as useful technologies, which could help them write. For example, when asked what technologies participants used to help them write, Chung-ting responded:

> Computers. The software, Knowledge Forum, is more outstanding, because it's sorted by different topics and we can share with other classmates our articles, which is different from writing using Word and sending it via e-mail.

The majority of participants held positive

reactions to computer use in writing instruction and most participants had positive perceptions when asked if this research could create a knowledge-building writing environment through design experiments. Chung-ting pointed out:

> Yes, but it takes much time to use. We use computer technology in our English writing class, which is good. However, it takes much time for us to search for the information on the Internet and to absorb it. In terms of creating a knowledge-building writing environment, I think this research is creating such an environment. For example, *Knowledge Forum* becomes our communal database where we can publish our opinions. The more students participate in the discussion, the more they will benefit from it. And in this environment, the discussion and the exchange of ideas can make us think of ideas when we see other people's different ideas. This way we can learn from other people interactively.

In addition, most participants preferred to form their own discussion groups and decide on their own discussion topics because they could discuss a wide range of issues rather than teacher-assigned topics.

4.4. Multivariate test results of participation rates and quality of writing

Overall, the research results suggest that these design experiments were successful. With respect to the quantity of participation in the *Knowledge Forum* database, both reading and writing increased for all 19 students, with a slight decrease in average number of notes (from 54.89 in stage 2, to 51.53 in stage 3), because discussion quality was more emphasized in stage 3 than in stage 2. The multivariate tests indicate a significant change over time, Wilks' Λ = .43, F (2, 17) = 11.14, p = .00 (see Table 3). The

Table 3 Multivariate Test Results of Participation Rates and Quality of Writing (N=19)

	Number of Notes Contributed per User	**Percentage of Notes that Were Read per User**	**Quality of Writing**
M	27.00 (stage 1) 54.89 (stage 2) 51.53 (stage 3)	26% (stage 1) 42% (stage 2) 76% (stage 3)	3.05 (stage 1) 3.87 (stage 2) 4.77 (stage 3)
SD	17.52 (stage 1) 40.14 (stage 2) 34.05 (stage 3)	24.07 (stage 1) 31.00 (stage 2) 24.20 (stage 3)	.66 (stage 1) 1.00 (stage 2) .56 (stage 3)
Wilks' Lambda Value	.43	.16	.08
F	11.14	46.06	95.47
Hypothesis df	2	2	2
Df	17	17	17
P	.00	.00	.00
Total (N=19)	19	19	19
Eta Squared	.57	.84	.92

average number of notes written by the participants rose from 27 in stage 1 to 54.89 in stage 2, and down to 51.53 in stage 3. As well, the proportion of CMC read by participants increased from 27% in stage 1 to 42% in stage 2, and to 76% in stage 3. The multivariate tests indicate a significant change over time, Wilks' Λ = .156, F (2, 17) = 46.06, p = .00 (see Table 3). In short, there was a general trend towards greater participation both in terms of number of entries to the database and the proportion of the database read.

With respect to the quality of essay writing, at the end of stage 3, students demonstrated that their essay writing quality improved. This is evidenced by the fact that at stage 3, 46% of the writing samples were identified as reaching the 'skilled' level, and 19% of the writing samples were identified as reaching the 'excellent' level. In short, the results suggest that students' attitudes changed and the rate of student contribution increased. Furthermore, students' essay writing quality improved. At stage 2, 20% of the students' writing samples had 5 text features in their writing, and 9% of students' writing samples had 6 text features in their writing. At stage 3, 46% of students' writing samples had 5 text features in their writing, and 19% of students' writing samples had 6 text features in their writing. To put it differently, a significant difference was found among the ratings of the quality of essays at stage 1 (M = 3.05; SD = .66), (M = 3.87; SD = 1.00), and stage 3 (M = 4.77; SD = .56), p < .00. The multivariate tests indicate a significant change over time, Wilks' Λ = .082, F (2, 17) = 95.47, p = .00 (see Table 3). In summary, there was a general trend towards an improved level of writing quality.

5. Discussion

This research was a study of the researcher's attempts to move from a traditional pedagogy model to a knowledge-building community model over a two-semester period by making efforts to examine how the epistemology, curriculum, technology, and so on shaped the transition. In this section, the researcher proposed some viewpoints, based on the results of the present research, in order to establish some possible design principles for an effective, reform-oriented educational innovation for EFL writing. The researcher described the most important nine design principles for an effective and reform-oriented educational innovation, which might transform an EFL writing classroom from a traditional work site into a knowledge-building EFL writing environment below.

5.1. Fundamental emphasis on knowledge and learning. Creating a knowledge-building EFL writing environment, as the research suggests, requires both the instructor's and the participants' commitment to knowledge and learning. According to the interview data, research participants frequently made comparisons between knowledge-building pedagogy and the traditional pedagogy that they were accustomed to. They noted the differences, and found that they appreciated the knowledge-building pedagogy, and that their essay-writing quality improved a lot. In order to foster a knowledge-building EFL writing environment, we regarded "thinking" in the course as a basic literacy ability, and deep understanding as the core of learning. This contrasts with the segmented retention of facts of traditional classroom practices. In this research, the participants took into account not only the task at hand but also the broader spectrum in which meaningful learning and knowledge transformation is embedded (Skillen, 1995).

5.2. Dialogic discourse. Research participants' average use of scaffold supports (see Appendix E) increased from 0 at stage 1 to 112.9 at stage 2, to 140.7 at stage 3, indicating participants' progressive engagement in dialogic discourse in writing. Dialogic discourse philosophically mirrors Bereiter and Scardamalia's (1993, 2005) idea of "progressive discourse" in a knowledge-building community. For Bereiter and Scardamalia, a community must be structured such that the participants are encouraged to engage in activities involving progressive discourse and resulting in collective knowledge advancement rather than simply the completion of tasks at hand (Bereiter & Scardamalia, 1993; Hewitt & Scardamalia, 1998). Viewed from this perspective, dialogic discourse is in line with Well's (1999) discussion of dialogic inquiry in education.

5.3. Focus on deep understanding. The types of scaffolds for 'theory building' (e.g., 'My theory', 'I need to understand', 'New information', 'This theory cannot explain', 'A better theory', 'Putting our knowledge together', etc.) prompt participants to focus on depth of understanding. For example, rather than asking yes/no questions, participants in the present research discussed high-level questions (e.g., "Discuss whether the lotto has had a positive or negative influence on our society and why?"). Depth of understanding was, furthermore, enhanced by the asynchronous nature of *Knowledge Forum* wherein participants were provided with more opportunities for reflection and deeper understanding than would be possible with other traditional face-to-face instructional practices (Hewitt, 1996).

5.4. Different/new roles of students and instructor. A central idea in the formation of a knowledge-building community through curriculum and instruction involves the different roles of students and instructor. For example, at stage 3 of this research, participants formed their own discussion groups and decided on their own discussion topics. The instructor, as the authoritative figure in the classroom, became merely a consultant in the course of participants' purposeful pursuit of deep understanding, and eventually, the participants took control of their own learning. In a knowledge-building community, the instructor, rather than being the primary source of domain knowledge and the authoritative figure, as in traditional classroom, functions as a consultant and a model in automatic and constructive critical inquiry. The students, in turn, become researchers and operators of progressive discourse, rather than recipients of incoming information.

5.5. Access to distributed knowledge and expertise. Research participants were provided with many opportunities to engage in discussions simultaneously on common issues. For example, participants in this research, through access to *Knowledge Forum*, could discuss a wide range of issues (e.g., abortion, pre-marital sexual relationships, cellular phones, pollution, pet-raising, cohabitation before marriage, euthanasia, stalkerazzi [paparazzo], copyright), and were able to exploit a wealth of distributed knowledge and expertise in a CMC environment without the constraint of time and space. Given their individual differences, students may be experts in a particular field of knowledge, but novices in others. It is difficult to completely make profit of each student's knowledge and expertise in traditional classrooms. However, CMC technologies dramatically increase our capacity to recognize and respond to participants' individual differences in their background knowledge, motivation, developmental stages, and learning styles (Chickering & Kytle, 1999).

5.6. Peer review and publication. In this research, the opportunity to foster collective cognitive responsibility for knowledge advancement by encouraging participants to read and build on other people's notes and then publish their own essays played a very important role in triggering participants' interest and involvement in what they were doing. Because of assistance from peers (as compared with working alone), the quality of what they created was ultimately better as well. In *Knowledge Forum*, the author of a note can make it a candidate for publishing, and when three other authors have sponsored the note, the note is then published. In this research, the researcher introduced the "publishing" function to the participants at stage 3, and in selecting essays for publication, the researcher asked them to examine their essays by moving backward from stage 3 to stage 1. The researcher counted 77 published essays in total: 3 essays at stage 1, 26 essays at stage 2, and 48 essays at stage 3. The quality of participants' writing greatly improved, indicating a remarkable progress over the two-semester period.

5.7. Interests and purpose. The participants in the present research enjoyed discussing the topics of their choosing rather than teacher-assigned topics. Similarly, they liked forming their own discussion groups and had their group essays published. There has been much debate, in the last two decades, over the relative importance of "process" and "product" with respect to the teaching of writing. However, this dichotomy of "process" and "product" is likely to become secondary when students are really interested in the issues they are discussing and have a real purpose for their writing (Wells & Haneda, 2000). The process of creating a knowledge-building community should involve the purposeful pursuit of knowledge and deep understanding, and the product should be "an increased proficiency among learners, both in term of collaboration and the ability to construct new knowledge – important skills that students will need to meet the challenges of the Information Age" (Hewitt, 1996). Consequently, the overall purpose of a knowledge-building community should be collective knowledge advancement. (Hewitt, 1996; Hewitt & Scardamalia, 1998).

5.8. Flexible design experiments. To try to answer the research question, the researcher used three "design experiments" in total over the two-semester period. The researcher's objective was to refine the design process and fine-tune both curriculum and technology in order to optimize participant interactions and reframe classroom discourse and, thereby, create a knowledge-building discourse community through computers. In order to confirm the research findings reported here, the researcher used a variety of methods, since the data collected from multiple sources may lead to a fuller understanding of the phenomena of study than those of a single source. However, a challenge in choosing which methods to use to assess participants' progress involves establishing which criteria are important in the research (Hsi, 1998). For example, researchers have different criteria for judging "meaningful learning," "knowledge transformation," or "productive discussion." Some writers of research methodology have called for "triangulation" – the practice of confirming one's findings by using a variety of methods and techniques.

5.9. Innovative multiple evaluation criteria. With regard to the assessment of participants' progress, new innovative pedagogies (such as knowledge building) featuring new educational

goals (such as deep understanding, high-level thinking, "idea-centered education" [Scardamalia, 2002]) call for new assessment methods. New assessments need to operate at a variety of levels. In creating opportunities for collaborative activities, the researcher used a number of innovative, multiple evaluation methods (e.g., testing the learning process more than the product, testing "in-situ", peer reviewing for publications, etc.). For example, in the research, the learning process constituted 60% of the participants' final grades (as compared to 40% for the mid-term exam and final exam). This process involved facilitating discussions of the readings/activities in *Knowledge Forum*, contributing notes, reading notes, and commenting on notes in the *Knowledge Forum* database. In a collaborative manner, participants were expected to participate and assist others in the process of building their knowledge and deepening their understandings.

These nine principles – fundamental emphasis on knowledge and learning, dialogic discourse, focus on deep understanding, different/new roles of students and instructor, access to distributed knowledge and expertise, peer review and publication, interests and purpose, flexible design experiments, and innovative multiple evaluation criteria – are worth paying attention to because, altogether, they may ultimately contribute to forming a knowledge-building community within this Taiwanese EFL population. This can effectively change the level of understanding for the student (Bereiter, 2002b). The research findings suggest that what triggers participants' active learning in a knowledge-building environment is their interest in authentic, real-life situations, which address social context issues, such as the lottery, abortion, mercy killing, cellular phones, air pollution, etc.

These above-mentioned nine principles, which emerged from the research in a Taiwanese context, have fair agreement with those twelve principles (i.e., real ideas/authentic problems, improvable ideas, idea diversity, rise above, epistemic agency, community knowledge/collective responsibility, democratizing knowledge, symmetric knowledge advancement, pervasive knowledge building, constructive uses of authoritative sources, knowledge building discourse, embedded and transformative assessment) proposed by Scardamalia (2002). While many of the principles overlap with the above nine, some principles appear underrepresented: the principles of 'improvable ideas', 'pervasive knowledge building', and 'constructive uses of authoritative sources', in particular. The researcher suggests that future research be needed to attend to those principles which were not highlighted in this study.

6. Conclusions and implications

The findings of this research reflect what Scardamalia and Bereiter (1999) refer to as a knowledge-building community and their belief that knowledge-building technology, *Knowledge Forum*, effectively facilitates participants' knowledge-building process (including positive attitudes, active and constructive involvement/participation, productive electronic discussion and purposeful contribution). It shows, as well, that new forms of interactivity and other various factors grounded in knowledge-building pedagogy contribute to meaningful learning and knowledge transformation in EFL argumentative writing and are ultimately conducive to creating a knowledge-building EFL writing environment. This may have significant implications for determining the design principles of an effective,

reform-oriented educational innovation.

To turn schools into knowledge-building communities, Scardamalia and Bereiter (1999) suggest a new discourse medium, computer network technology, to provide possibilities for more decentralized forms of discourse, which have more of the knowledge-building capabilities of discourse across the disciplines. In this research, the classroom culture changed over a two-semester period to the extent that students' positive attitudes and contribution were significantly promoted. As a result, their writing quality improved a lot. The epistemology, innovative curriculum, and knowledge-building technology altogether helped to shape the transition.

It is also important to acknowledge that there are some limitations to the study. For example, only one kind of CMC technology – *Knowledge Forum* – was used in the present research. Therefore, more dialogues are invited and more research is encouraged in order to verify how knowledge-building pedagogy, aligned with other kinds of CMC technology, can serve as a means for knowledge building. Therefore, future research will be needed to verify these findings. However, these data do give us some ways to move ahead now and continue with innovations.

As education innovators, we need to avoid emphasizing too much on the flashy magic and recognize that "bells and whistles" are only valuable when they are in the service of an overarching pedagogy. The pedagogy proposed here is knowledge-building pedagogy. Education innovators also need to remember that CMC technology alone cannot reform education; instructors and students can. Only when instructors and students are supported by innovative pedagogy and well-designed CMC technology can education move forward (Cates, 1992). In short, the researcher proposes that an interweaving of reform-oriented pedagogy and meticulously-harnessed CMC technology can bring about educationally effective innovation and improved language learning (Kern, 2000) and may hold promise to open up new possibilities for our EFL students.

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Appendix A

Summary Table of Time Period, Rationale, Classroom Procedure of Innovations, Expected Outcome, Observation Result by Stage

Stage 1: Time Period, Rationale, Classroom Procedure of Innovations, Expected Outcome, Observation Result
Time Period: 2 months, two regular 50-minute class periods, the time involved was 100 minutes in class per week. **Rationale:** In order to show students the features of a good research article, the researcher collected samples of argumentative essays that served as a reference set. The researcher asked the students to participate in discussion with other students. At this stage, the researcher encouraged the students to come up with ideas that might improve the features of the reference set. Later, the students analyzed the argumentative essays of the reference set, using the features of good argumentation. Again, the researcher asked the students to raise their questions or comments for discussion and the researcher encouraged them to engage in a collaborative project and then present their work as a way to share their knowledge. At the end of the first month, the researcher instructed students to discuss the following question. *Do you agree or disagree with the following statement? Teachers should make learning enjoyable and fun for their students. Use reasons and specific examples to support your opinion.* I gave students 15 minutes for the discussion. The n the researcher asked them to write an argumentative/persuasive essay based on the assigned discussion topic. **Classroom procedures of Innovations:** The researcher introduced four interventions to the students: (1) modeling and practicing, (2) guided practi ce, (3) a reference set, and (4) argumentative structure. The purpose was to know students' perceptions of a good argument and verify whether or not they improved the quality of their writing. **Expected Outcome:** Students may work collaboratively. **Observation:** However, research data suggest that students failed to work collaboratively at this stage.
Stage 2: Time Period, Rationale, Classroom Procedure of Innovations, Expected Outcome, Observation Result
Time period: 2 months, two regular 50-minute class periods, the time involved was 100 minutes in class per week. **Rationale:** Design experiments for stage 2 targeted greater interactivity through the development of community. To promote new forms of discourse in a technologically-mediated learning community, the researcher guided students to use general reasoning skills and to contribute to this community. At

this stage, students were expected to transform the knowledge they gained during the previous stage into an argumentative/persuasive essay, which they were to write on their own. Thus, students were able to construct ubiquitous knowledge (Scardamalia, 2002) and apply it to different contexts.

Classroom Procedure of Innovations: The researcher introduced the following three interventions:

1. Emphasis on the importance of a learning community.
2. Collaborative participation in Web KF. The researcher guided students to participate, and assist others, in a collaborative manner, in the process of building their knowledge and deepening their understandings.
3. Students as discussion leaders and facilitators. The researcher guided each group of students to be responsible for leading the discussion of the topics during this stage.

The activities students actually performed in Web *Knowledge Forum* primarily involved contributions to the Web *Knowledge Forum* database. This included creating individual notes, commenting on other students' notes, reflecting on other students' notes, giving feedback to other students about their notes, and writing an argumentative/persuasive essay at the end of this instructional period. The second research period was from the third month to the fourth month. Finally, the researcher asked students to discuss the following three questions (from TOEFL, 2001, p. 1) and write their response to them.

1. *Do you agree or disagree with the following statement?*

   Parents are the best teachers.

   Use specific reasons and examples to support your answer.

2. *Many people visit museums when they travel to new places. Why do you think people visit museums? Use specific reasons and examples to support your answer.*

3. *Some people believe that university students should be required to attend classes. Others believe that going to classes should be optional for students. Which point of view do you agree with? Use specific reasons and details to explain your answer.*

Expected Outcome: Guided discovery.

Observation: Observational data, however, suggest students were more interested in discussing the topics of their own choice than teacher-assigned topics.

Stage 3: Time Period, Rationale, Classroom Procedure of Innovations, Expected Outcome, Observation Result

Time Period: 3 months, two regular 50-minute class periods, the time involved was 100 minutes in class per week.

Rationale: To realize a substantial knowledge-building pedagogy, according to Hewitt and Scardamalia (1998), would involve active and constructive student collaboration, effective peer interactions, more and different forms of discourse, distributed knowledge-building processes, communal solving of problems, awareness of participants' contributions, students' building on each other's work, and a sense of the community. At this stage, students were expected to transform the knowledge they gained during the previous stages into an argumentative/persuasive essay, which they were to write on their own. Thus, students would be able to construct "ubiquitous knowledge" (Scardamalia, 2002) and apply it to different contexts.

Classroom Procedure of Innovations: The researcher introduced the following four interventions at this point:

1. Exercise of students' agency over their topics and grouping. The researcher encouraged students to choose the discussion topics and form their own discussion groups.

2. Focus on high-level questions. The researcher encouraged students to capitalize on high-level questions for discussion.

3. Multiple evaluation criteria. The researcher used a number of multiple evaluation methods (e.g., testing the learning process more than the product, testing "in-situ"…etc.).

4. Students' peer reviewing for publication of their essays. The researcher encouraged students to do peer review and have their essays published.

The activities students actually did in *Knowledge Forum* primarily involved contributions to the Web *Knowledge Forum* database. This included students' individual notes and incorporation of their own notes, along with those of other students, which they had replicated into the view. To realize a substantial knowledge-building pedagogy, the researcher encouraged students to engage in activities that would alter their relational understanding of their arguments. At this stage, students were required to transform the knowledge they gained during the previous stages into an argumentative essay, on a topic of their own choosing, which they were to write on their own.

Expected Outcome: Students' relational understanding can be increased.

Observation: The design experiments were effective in shifting the classroom culture toward knowledge building, but that more time would be needed to fully achieve the expected results.

Appendix B

Coding Category and Quality of Student's Essays

Coding Category	Coding Value
Unable to rate (no feature in text organization)	**0**
Unsatisfactory (1 feature in text organization)	**1**
Insufficient (2 features in text organization)	**2**
Uneven (3 features in text organization)	**3**
Sufficient (4 features in text organization)	**4**
Skilled (5 features)	**5**
Excellent (6 features)	**6**

P.S. Features in text organization include position, evidence, summary, parallel progression, sequential progression, and extended progression.

I. Examples of the coding categories:

Unable to rate: There is no feature in text organization (e.g., the author did not take a position).

Unsatisfactory: There is one feature in text organization (e.g., t he author took a position).

Example: “In my opinion, I agree that “the teachers should make learning enjoyable and fun for their students…”(Huei-chia, uncorrected)

Insufficient: There are two features in text organization (e.g., the author took a position and supported it with a reason or example).

Appendix B (continued)

Example: “In my opinion, I agree with that teachers should make learning enjoyable and fun for their students…For example, a funny learning will excite students’ interests in studying….” (Zeng-pei, uncorrected)

Uneven: There are three features in text organization (e.g., the author took a position, supported it with a reason and/or example, and had a summary).

Example: “I think that learning in a good atmosphere environment is important…I f teachers can attract more students’ attention, they would raise students’ interests in learning way…In summary, teachers should make learning enjoyable and fun for their students….” (Yii -ting, uncorrected)

Sufficient: There are four features in text orga nization (e.g., the author took a position, supported it with a reason or example, had a summary, and had parallel or sequential progression).

Example: “Personally, I agree with the statement that teachers should make learning enjoyable and fun for their students…I will use some reasons to explain my position… First, we go to school because we want to learn knowledges from teachers. If teachers can provid students an enjoyable environment to learn, they will pay more attention to the subjects…Second, I thin k the relationship of interact between teachers and students is very important. To sum up, to make learning enjoyable and fun for the students is the responsibility of the teachers…. (Min -yue, uncorrected).

Skilled: There are five features in text organiza tion (e.g., the author took a position, supported it with a reason or example, had a summary, and had parallel and sequential progression).

(see for example, Appendix D)

Excellent: There are six features in text organization (e.g., the author took a positi on, supported it with a reason or example, had a summary, had parallel/sequential/extended parallel progression).

Appendix C

Qualitative, Open-ended Interview

Students' Goals for Improving their EFL Argumentative Writing, and Their Feedback to and Perceptions about the Design Experiments in this Research

1. general

   In general, what is your general reaction to this research? How do you feel about this research? What is it you like most about this research? Please give examples.

2. genre (text type)

   Is this research effective in terms of improving your argumentative writing? If yes, in what way? Please give examples.

3. composing processes

   Do you think the reference set (topical structure analysis and text organization of argumentative essay) is useful to you when you write? How do you take advantage of this reference set to improve your writing? Are you trying to improve this? Please give examples.

4. course outline

   What do you think of the course outline? Are you trying to improve this? Please give examples.

5. information sources

   Where do you get your information from for writing? (e.g., your own ideas, experiences, other people, books, internet, etc.) Is there anything you are trying to improve about this? Please give examples.

6. difficulty with argumentative/persuasive writing

   What are your problems of difficulty with argumentative/persuasive writing? Are you trying to improve your argumentative/persuasive writing? How? Please give examples.

7. collaborative learning

   Do other people (e.g., classmates, friends, family, instructors) help you to write? How? Please give examples.

Appendix C (continued)

8. tools

   What tools do you use to help you write (e.g., pen, computers, special location, books)? Are you trying to change this? Please give examples.

9. computer use in writing instruction

   Do you think that CMC technology (Web KF) can help you to improve your quality of writing, in general, argumentative/persuasive writing, in particular? Do you think that this research creates a knowledge-building writing environment through design experiments? Please give examples.

Thank you very much for taking the time for this interview!

Appendix D
One student's Essay

Most of the colleges and universities offer many classes besides their majors for students to choose. In my opinion, I agree that students should take other courses besides their majors. There are several reasons why I agree with the idea. First, it is essential for students to acquire as many skills as possible in order to be competitive enough when seeking jobs. Second, knowledge is power. Third, students might discover new interests besides their major courses and moreover acquire other specials. I will raise some reasons and evidence to support my point of view.

First, it is crucial for students to acquire as many professional skills as possible when they seek jobs. There is a lot of competition out there after you graduate. You need to have enough preparations for the challenges you might encounter. For example, if you were a boss, there were two graduates loo king for one position. One spoke good English, the other not only spoke Fluent English but also got a business degree. Who would you hire? The answer was obvious —the one with more skills. One professional technique is no longer fit the human resource marke t. It is a highly competitive society. People will have to fulfill themselves in order to adjust to the trend. Therefore, I suggest that it is important for students to learn other things when they are at school.

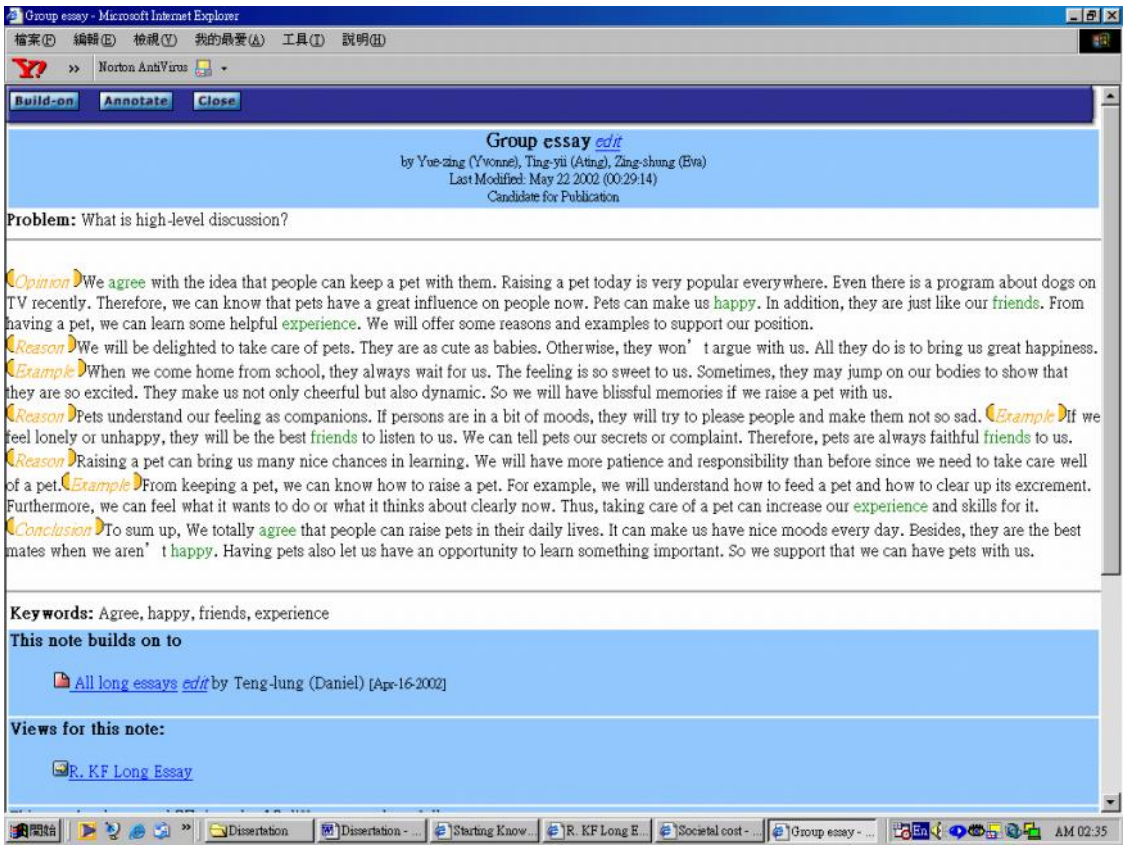
Second, knowledge is power. People need t o acquire more knowledge to keep them open -minded. It is a world of diversity. New things are going on everywhere in any minute. There is an easiest way for students to obtain knowledge which is to take as many classes as you can. This is the most efficien t way to do it, especially for college students. Otherwise, it is just sort of wasting time to hang around the campus and get nothing done. College students should have the sense that knowledge is not only the tools to make fortune but also to enlarge both your brain and mind. So I think college students should take more classes besides their majors.

Third, you might discover new interests when you take other classes. For instance, I am English major, I coincidentally took a Japanese history class and I e nded up loving that class a lot. I am thinking of taking history as my second major. Of course you do not have to take other classes except for your major. However, you will just lose a lot of fun of knowing new things and learning more. That is why all the universities have general education courses. It is to help student to develop other interests and hobbies and I truly think that college students should take the advantage on this.

All in all, we are facing a world of changes and diversity. In fact, ve ry few people are doing what their majors were after they graduate. College student should really think about this seriously. Students should eventually care about knowledge and skill acquisition, the power of knowledge, the developing new interests and le arning new things. Think of all positive sides mentioned above, I do think college students should take more classes besides their majors. (Chi -weng, uncorrected. essay rating: 5, based on Appendix B)

Appendix E

Scaffold supports' note – 'Group Essay'



專論

Design Principles for EFL Writing Instruction in a Technologically-mediated Knowledge Building Environment

Deng-Long Peng

The purpose of the research was to find out the design principles of an effective, reform-oriented educational innovation in a technologically-mediated knowledge building environment that teacher-researchers may employ in order to transform a university EFL classroom culture from a traditional pedagogy model to a knowledge-building community model. The participants in the research were nineteen second-year university students of the Department of Applied Foreign Languages of a university of technology in Taiwan. Among the 19 students, 4 were male and 15 female. The ages of the 19 participants ranged from 20 to 23, and they had studied English in Taiwan for 7 to 10 years. Three "design experiment" (Bereiter, 2002a; Brown, 1992) iterations were carried out, over two-semester period, to assess how the epistemology, curriculum, technology, new forms of interactivity, knowledge-building environment, and educational innovations shaped the transition. Three kinds of data were collected at the end of the iterations: (1) quantity of participation in *Knowledge Forum*®; (2) quality of essays; and (3) qualitative, open-ended interviews. The findings suggested the quantity of students' participation increased and their essay-writing quality improved. It was concluded that the design experiments were effective in shifting the classroom culture toward knowledge building community model, but that more time would be needed to fully achieve the expected results.

keywords: EFL, writing instruction, knowledge building community, design experiment

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