Multimedia courseware development for World Heritage sites and its trial integration into instruction in higher technical education

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This study reports on creative ways of using technology in the classroom, specifically the development of multimedia courseware on World Heritage through which learners are able to upgrade their knowledge and cognition regarding historical and cultural legacies from the past, and to improve English skills. The content of the pilot courseware included introductory texts about ten famous World Heritage sites combined with integrative English learning skills: reading, listening, speaking, writing and translation. An online evaluation system with an instant self-checking function was created to allow learners to examine work for themselves immediately and understand their learning progress and achievements. The courseware design was based on Mayer's multimedia learning cognitive theory, and the language learning focus drew on Chapelle's suggested criteria for development of multimedia, computer-assisted language learning (CALL). The courseware has been tried and used by two groups of students: sophomore and junior students of English as a foreign language (EFL) in a technical university in Taiwan. Initial evaluations suggest that students were satisfied with learning through courseware integration and their vocabulary comprehension was significantly improved. Junior students with higher English proficiency became more focused on practices of English skills and related learning activities, also also more satisfied with the content and design of the courseware.

Introduction

In Taiwan, the Ministry of Education has issued specific objectives for curricular interpretation, including these: (1) Cultivate basic knowledge about the humanities, such as about people and literature; (2) Enhance students' skills and desire in serving society; and (3) Improve students' understanding of global affairs. In addition, a primary objective of foreign language education identified by the Ministry of Education of Taiwan for technical and vocational education is to provide students with the foreign language ability and advanced professional knowledge. This development trend makes English for specific purposes (ESP) an important topic of recent discussion.

ESP is well known as a learner-centered and content-based approach to teaching/learning English as a foreign language, which meets the needs of learners who need to learn English for use in their specific fields, such as business, science, technology, medicine, leisure, and academic learning (Hutchinson & Waters, 1987; Johns & Dudley-Evans, 1991; Dudley-Evans & St John, 1998). *World Heritage* is the collective property of humanity viewed as irreplaceable sources of life and inspiration.

Due to the lack of wide understanding of the need for protection and preservation, some of the world's outstanding cultural and natural sites are in danger of deteriorating or disappearing. The responsibility for protecting these sites is international and lies with all people in the world. However, there are few related courses given in the curriculum of higher technical education for students not only to identify global World Heritage sites that are irreplaceable sources of life and inspiration, but also to increase their recognition of the need for protection and preservation for such a collective property of humanity.

With the explosive growth of e-learning, a technological revolution is currently taking place in higher education. E-learning is a learner-centered educational system which enables learners to learn whenever, wherever and whatever the learners want to learn according to their learning objectives (Rosenberg, 2001). This value and benefit corresponds to requirements of developing materials or courses in ESP, in which content and method are based on the learner's needs. There are some problems in the development of ESP courses in Taiwan. After investigating the relationship of the English proficiency level of about 350 students in four technical universities, their needs when taking ESP courses, and their expectations of an ESP teacher, Lai (2005) found: (1) sufficient qualified teachers, authentic materials and specific knowledge of key areas are not available; (2) students taking ESP courses want to be able to improve integrative language skills such as listening, speaking, reading and writing; and (3) students need to have a higher level of English skills in order to perform well or attain a high level of learning in ESP courses.

These needs can be met to some extent by CALL methodologies and materials because CALL can provide numerous advantages in the areas of contextual (Brett, 2000; Shamsudin & Nesi, 2006; Tsai, 2009; Tsai & Davis, 2008), self-paced, autonomous and individualised learning (Figura & Jarvis, 2007; Fischer, 2007; Ma, 2007; Wagener, 2006), motivation (Cheng, 2009; Chang, 2005; Papastergiou, 2009), feedback and evaluation (Dickinson, Soojeong, Kang, Lee & Sachs, 2008; Heift & Rimrott, 2008; Hémard, 2006). In addition, integrative CALL was developed, which involves authentic uses of the language and by the use of interactive multimedia, language skills can be integrated easily for learners' practice, such as listening (Brett, 1997; Romeo, 2008; Rost, 1990), speaking (AbuSeileek, 2007; Laborda, 2009; Tsai, 2011), reading (Abraham, 2008; Hsieh & Dwyer, 2009), and writing (Chang, Chang, Chen & Liou, 2008; Futagi, Deane, Chodorow & Tetreault, 2008).

Courseware, also called instructional or educational software, is widely used in higher education as an integral part of the courses. Although courseware development and its application in classroom lectures is becoming more greatly emphasised, both its design and its use have been more focused on courses related to sciences and technology (Azemi, 2008; Jiménez & Casado, 2004; Li, 2004; Shamsudin & Nesi, 2006; Tsai, 2009). This trend is possibly due to the abilities of instructors in these fields, who have more competent skills and knowledge of multimedia software and programming, to convert lecture notes into interactive multimedia courseware available to students. Besides, a review of the literature and of related courseware finds there is no similar courseware through which an introduction to World Heritage Sites and an integration of English skills (listening, speaking, reading, writing and translation) can be provided. Thus, the effectiveness of these teacher-customised instruction tools has not been fully realised or studied in ESP courseware development in Taiwan, which is an interdisciplinary task that emphasises coordination and integration of subject knowledge, language learning, and multimedia and information technologies.

Purpose of the study

The aim of this study is to initiate the development of a bilingual multimedia courseware (English and Chinese) for famous and scenic sites on the World Heritage List, for higher technical education students, through which Chinese-speaking learners not only will learn about such great historical and cultural legacies to increase their awareness of their responsibility, but also improve their related English skills. The courseware for World Heritage developed in this study was related to culture, history, tourism, and leisure, and was determined by needs analysis of the four parties: UNESCO (United Nations Educational, Scientific and Cultural Organization), Ministry of Education, the University and the students.

UNESCO is trying to arouse responsibility for protecting outstanding cultural and natural sites that is international and lies with all people in the world. In addition, in the guidelines of the curriculum for technical and vocational education identified by the Ministry of Education of Taiwan, the development of students' inclination toward the humanities and the enhancement of their understanding about global issues are considered to be one of the general core abilities to be established and supported by the University. After being developed, the ESP courseware for World Heritage was integrated into instruction by allowing computers to play a central role as the means of information delivery to help students to construct and promote integrative English skills through their direct interaction with the courseware. The effectiveness of the courseware's trial in promoting students' linguistic fluency has been probed. In addition, the learning strategies and attitude of students are discussed, both qualitatively and quantitatively.

Methodology

The courseware design and its trial were conducted under the 'ADDIE' (Analyse, Design, Develop, Implement, Evaluate) framework (http://ed.isu.edu/addie/). A computer-aided language learning (CALL) approach (Warschauer, 1996) combined with task-based learning (TBL) approach (Nunan, 1989; Skehan, 1998) was adopted. In general, TBL includes three principal phases: *pre-task*, *during task*, *post-task* (Ellis, 2006). The task of the study was to ask students to conduct a cloze test before and after their self-study with the courseware in which students were asked to fill in the blanks with words given in a word list to complete the sentences. These pre-tets and post-tests required students to demonstrate understanding of context and vocabulary to identify the correct words, and meanwhile were considered as a quiz for which scores were included in students' grades. It encouraged and motivated students to more actively interact with self-studying the courseware, and to better understand their reading comprehension.

During the *pre-task phase*, students had to conduct a cloze test through which they previewed the task objective, and had to think ahead about how to do the task and plan the knowledge and language they would need. Then, based on the feedback from the pre-test, students acquired a better understanding about what would be expected while completing the tasks. In the *during-task phase*, the students studied with the courseware on their own and the teacher mainly played the role of an observer or counselor. Such a role limited the teacher's intervention to working to understand students' ability to handle autonomous learning and to apply what they learned to the post-tests. During the *post-task phase*, a post-cloze test was conducted and, based on

students' actual performance, the teacher provided written and oral feedback including language forms that students were using, problems that students had with language and organisation, and progress that students made. In the end of the course, students were asked to complete the questionnaire of satisfaction to provide some notion of their perceptions of learning effectiveness after their self-study with courseware in the previous phases. The methodology of this study was divided into two phases, development of courseware, and trial of courseware, and is discussed in that order.

Development of courseware

The basic steps used to develop the courseware in this study included *Background analysis*, *Mining and selection of data*, *Structure design of content and its production*, *Digitalisation of content*, *Multimedia design*, *Integration of content system*, *Testing and modification*, and *Courseware completion* (Tsai, 2009). The content of the courseware incorporated subject content and ESP emphases through multimedia software such as *Java Script, Photoshop* and *Hypermedia*, to integrate all aspects of resources (text, audio, pictures) into the system. The courseware design was essential to the effective use of multimedia and educational technology so that the interaction between the meaning and media could be conducted in the learning process. The courseware attempted to incorporate Mayer's multimedia learning cognitive theory (2001; 2005). In the courseware, authentic texts with L1 (first language: English) audio and Chinese translation support, narration, practices of language skills, online tests with instant self-checking, and graphical images were all presented. This layout aimed at meeting Mayer's temporal and spatial principles which suggest that people learn better when corresponding words and pictures are presented, simultaneously, and near rather than far from each other on the page or screen. In addition, texts were implemented in learner-paced segments so that students could control their learning pace and educational experience for repetition, deliberate practice and self-evaluation with the courseware, which corresponds to the pacing principle: the pace of presentation is controlled by the learner, rather than by the program (Moreno & Mayer, 2000).

The World Heritage sites included in the courseware were selected from various continents of the world: *Summer Palace in Beijing, Moscow Kremlin, Borobudur Temple Compounds, Jerusalem, Fontainebleau, Great Zimbabwe, Thebes, Sucre, Galapagos Islands*, and the *Statue of Liberty*. The introductory English text for each site was excerpted from the official website of UNESCO World Heritage site (http://whc.unesco.org/), and edited by an experienced English-native instructor majoring in linguistics. The English texts combined with their Chinese translation were given in as brief and readable a form as possible, about 100 words for each site in order to decrease text complexity and promote better understanding. In addition, each site was hyperlinked to its official website at World Heritage Centre so that learners had access to a wide variety of authentic materials through which they could further experience real-life exploration about subject knowledge and languages.

Trial of courseware

The courseware was respectively implemented in an elective course "English Reading for Technology" for sophomore EFL students (second year undergraduates) and in another elective course "English Listening and Speaking Training for Technology" for junior EFL students (third year undergraduates) in the Applied Foreign Languages

Department (AFLD) at a technical university in Taiwan. The design of the course is described below.

Table 1: Result of students' online TOEIC-like test

Group	Number	TOEIC-like test		
		Overall mean	Mean for listening	Mean for reading
Sophomore	38	43.5	29.3	14.2
Junior	42	47.5*	27.8	19.7*

* $p<.05$, significant difference in the TOEIC-like test between sophomore and junior students

1. *Target audience:* The pilot courseware was tried by two groups of students: 38 sophomore and 42 junior EFL students. In the pre-task phase, the students completed a TOEIC-like test which focused on listening and reading, two main input channels for learning. The mean of the TOEIC-like test was transferred to the scale in which the highest score is 100. As a result, junior students had a higher mean score (47.5) than sophomore students (43.5) as shown in Table 1. The analysis through the independent samples *t*-test of students' TOEIC-like test score indicated that junior students had a significantly higher English proficiency (p=.034<.05), mainly due to their significantly better ability in reading (p=.000<.05).

2. *Learning context:* The courseware was installed on the laboratory server so that each student was able to easily access its content through their computers linked to the laboratory intranet. As a trial of the courseware integration into instruction, students were just asked to self-study 3 sites (*Kremlin, Fontainebleau*, and the *Statue of Liberty*) for 1.5 hours, 30 minutes for each.

3. *Instruction*: The multimedia courseware, as a silent partner, played the role of a peer and an adjunct language teacher with which students actively explored and interacted with content knowledge, at the same time practising relevant linguistic fluency according to the curriculum schedule controlled by the teacher. In that sense, the courseware was a major medium for delivering and transferring subject content and language practices. The teacher supervised and observed students' behaviors and learning, and encouraged their self-learning with the courseware.

4. *Assessment*: In order to elicit and understand students' learning effectiveness, the same cloze test with 8 questions was conducted before and after students' self-studying the content of the three target sites. All the questions in the cloze test were extracted from the content of the three sites. The scores of the pre- and post-tests were included in their grade. It allowed for a higher instrumental motivation that is generally characterised by the desire to obtain something practical or concrete from the study of a second language (Hudson, 2000).

5. *Questionnaire survey*: Evaluation of the ESP instruction with courseware integration was also obtained from a questionnaire of satisfaction (QF) which included 15 questions and was administered at the end of the post-test in the post-task phase (Tsai, 2009; 2010). QF1 concerned improvement for the target field. QF2-QF7 concerned the suitability for practice of English skills including vocabulary, listening, speaking, reading, writing and translation. QF8 and QF9 were related to the relevance of the subject content and its English, and QF10 and QF11 respectively corresponded to the hyper-linking of the courseware and the instant online evaluation system. QF12 concerned motivation promotion through the

bilingual and easy interface design of the courseware, and QF13 was related to navigation of the courseware. QF14 and QF15 were respectively related to students' recommendation for the courseware and learning with courseware integration. Each question of the satisfaction questionnaire used a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"), including Very Satisfied (5), Satisfied (4), Average (3), Not Satisfied (2), Disliked (1). All returned questionnaires were analysed through *SPSS*. An open-ended question (which was not required to be answered) was proposed to understand students' other suggestions or comments.

Results

Courseware development

The courseware design is based on Mayer's multimedia learning cognitive theory (2001, 2005). Ten World Heritage sites are prominently shown on the main page when learners access the courseware, shown in Figure 1. For convenience, a "Text Print" button on the bottom right of the screen will allow teachers or learners to print all the text of the courseware to facilitate teaching or learning, if necessary. By clicking any button of the sites on the main page, learners can access the content and activities of the site.

Figure 1: Main page of the courseware for world heritage including ten sites

The learning content of the selected site is presented in a screen shown in Figure 2, in which all the learning activities will be conducted. By clicking the picture on the upper right side of the screen, the official website of the selected site is hyperlinked in order that additional materials or resources can be accessed for learners' further engagement. After the brief introduction through the content text of the courseware, this design, which sends learners directly to official sites, allows learners to be situated in a larger context including more endangered sites throughout the world. This emphasis on wider contextualisation is drawn from the cognitive apprenticeship model which

suggests learners' individual knowledge and skills can be acquired and constructed by being exposed to authentic activity, context, and culture (Brown, Collins & Duguid, 1989; Cheaney & Thomas, 2005; Hung & Der-Thanq, 2001; Kevin, 1999).

On the lower right side of the screen, five types of online tests for language learning are provided, including pronunciation, cloze test, sentence restructuring, listening test, and translation writing. The interface design has been done in a bilingual version (English and Chinese) in order to create a friendly interface for Chinese learners. This learner-centered and logical layout with guidance and navigation aids corresponds to the principles of guided-discovery, navigation and site map in the advanced principles of multimedia learning proposed by Mayer (2005). Learners can choose any learning activity that they are interested in, to study at their own pace.
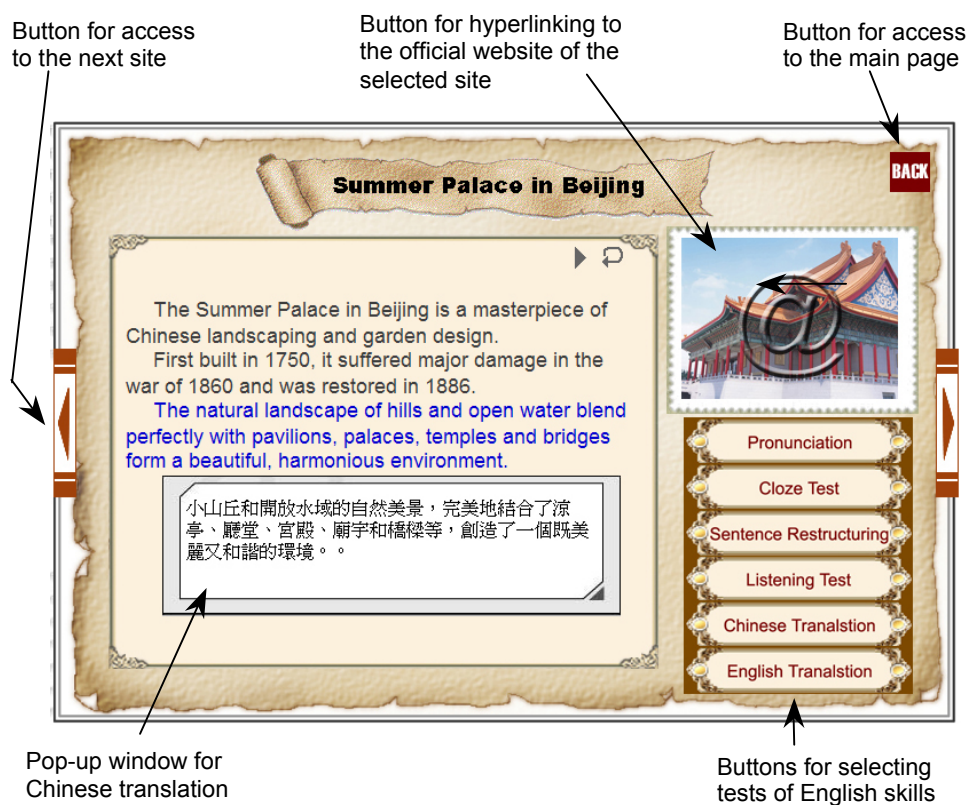

Figure 2: Content and learning activities for a selected site

The operational mode of language learning offered by the courseware is explained below. After any paragraph of the English text in the learning units is touched by the mouse, the color of the paragraph becomes blue, shown in Figure 2. The paragraph is being spoken in English with L1 audio as learners click on left button of the mouse. This allows learners to practise English reading skills, and helps improve the learners' pronunciation and listening ability. This multimedia message with words presented with spoken language corresponds to the modality and multimedia principles (Mayer, 2001), which facilitates learners to construct verbal and visual cognitive representations and integrate them. In addition, learners can use the audio recording

system offered by Microsoft *Office* to record their pronunciation, which allows learners to practice their English speaking skills. Besides, after clicking the right button of the mouse, the Chinese translation will be given in a pop-up window shown near the paragraph as shown in Figure 2. This design corresponds to Meyer's temporal and spatial contiguity principles (Mayer, 2001) by means of which better transfer occurs. The bilingual support will allow learners to have a better comprehension, as well to practise English translation and writing skills.

The online test and evaluation system includes five language tests with different levels of difficulty in which students are offered opportunities for applying five English skills: listening, speaking, reading, writing and translation. Such an integration of language skills in the courseware design allows learners to be able to practise a variety of language skills while taking ESP courses. When any test is selected, all the questions in the test are randomly chosen by the program for learners to practise on. In addition, all these learning activities are combined with an instant self-checking function in order that learners can monitor their progress and examine themselves immediately. If learners do not know how to answer the question, the L1 audio of the reference answer can be played by clicking the button of bell shown at the end of the question, which allows learners to be able to find the right answer. This learner-centered cue design reduces cognitive load and learning difficulty and helps learners find the answer by themselves, which meets various learning needs of learners in conducting activities of assessment and evaluation. This design is especially destined for learners with lower English proficiency, corresponding to the prior knowledge principle in Mayer's advanced principles of multimedia learning (Mayer, 2005). The examples of the cloze and sentence restructuring test is shown in Figures 3 and 4. Since learners have the freedom to practise all the learning activities at their own pace and learning need, this advantage of the pacing principle in e-learning allows learners to have enough time to engage in the cognitive processes of selecting, organising, and integrating what they acquire in the learning process in a fearless and unconstrained environment (Moreno & Mayer, 2000).

Figure 3: The self-checking system for the cloze test. The incorrect part of learners' reply is shown in red, and its reference answer is in green.
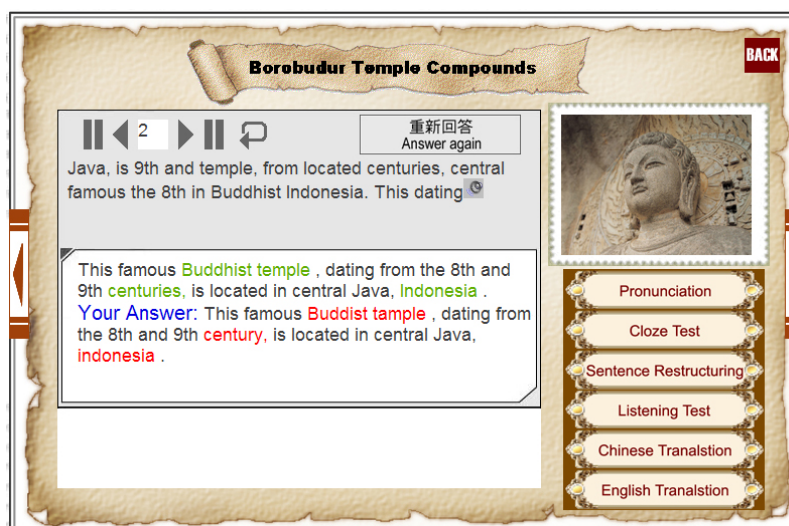
Figure 4: The self-checking system for the sentence restructuring: the incorrect part of learners' reply is in red, and its reference answer is in green.

Meanwhile, the courseware layout corresponds to Chapelle's suggestions for multimedia CALL (1998) based on hypotheses about ideal conditions for second language acquisition. The ESP courseware developed in this study, incorporating L1 audio with paragraph subtitles, can be an instructional tool to support ESP approach in higher technical education in which students' English skills and their comprehension can be promoted. For example, the color of the paragraph will change when being touched by the mouse. These features in colour, audio, and translation correspond to Chapelle's first suggestion mentioning making key linguistic characteristics salient by highlighting them in a different color, in aural input, or transcription of phrases containing linguistic elements.

Chapelle's second suggestion concerns linguistic input provided through either written or aural language and modified in several ways such as repetition, simplification through restatements, non-verbal cues, decreased speed, reference materials, and change of input mode. This can be achieved by repeatedly practising integrative language skills with written English texts and its L1 audio offered by the courseware. These types of linguistic modifications are distinct from the materials found on the Internet because they hold the potential to provide learners with comprehensible input rather than just input. Of course, the courseware network-linking to the Internet can also offer another channel for learners to gather and use authentic materials for conducting meaningful exploration in real life contexts.

The online evaluation system includes a variety of language tests with different levels of difficulty, such as pronunciation, cloze test, sentence restructuring, listening test, bilingual translation writing (Chinese to English, and English to Chinese) for learners to practise integrative English skills. These practices provide learners with opportunities for comprehensible output which can be done either written or spoken by using target language forms to stretch their competence, as mentioned in Chapelle's third suggestion. Besides, the repeated practice and instant self-check function of the online evaluation system allow learners to analyse, recheck, reflect, and identify, and

even correct their errors. These designs correspond to Chapelle's fourth and fifth suggestions regarding the provision of opportunities for learners to notice their errors and correct their linguistic output. The sixth and the last suggestions imply supporting modified interaction between the learner and the computer and acting as a participant in L2 tasks. It can be accomplished by several functions provided by the courseware through mouse clicks, hypertext links, and a variety of learning activities in language and in subject content. It is shown to be effective in the results of the questionnaire of satisfaction. Of course, the details of the interaction need to be viewed and monitored within the context of the task.

Courseware trial and questionnaire survey

The mean of the questions in the pre- and post-cloze tests that students gave the right answer are presented in Table 2. Since most sophomore and junior students were not familiar with the context and vocabulary of the three target sites so that their means of giving right answers were lower in the pre-cloze test. A further analysis of the paired samples *t*-test showed that there was a significant difference in students' scores between the pre- and post-cloze tests ($p=.000<.05$). It indicated that sophomore and junior students all made significant progress in the post-cloze test after self-studying with the courseware, and there was no significant difference in the pre- and post-cloze tests between sophomore and junior students.

Table 2: Results of students' pre- and post-cloze tests *t*

Group	Number	Mean of giving right answer	
		pre-cloze test	post-cloze test
Sophomore	38	4.66	7.58*
Junior	42	4.74	7.64*

* $p<.05$, significant difference in students' scores between the pre- and post-cloze tests

In order to understand the relationship between the English proficiency of sophomore and junior students determined by the online TOEIC-like test and their performance in the pre- and post-cloze tests, a Pearson correlation analysis was conducted. This indicated that students' English proficiency had a significantly positive correlation with their performance in the pre-cloze test ($r=.391$, $p=.000$), but no correlation was found with students' performance in post-close test ($r=.053$, $p=.641$). According to Pressley (1998), learners' English reading comprehension can be divided into two levels: vocabulary comprehension and content comprehension. Vocabulary comprehension is a lower comprehension level and it requires a sufficient word bank to recognise a certain word. The above result implied that students' vocabulary comprehension improved, and also the performance discrepancy of students with different English proficiency in the post-cloze tests was effectively reduced after their active participation and engagement with the target content.

As for the questionnaire of satisfaction, the choices students selected for each question were averaged and the standard deviation was analysed. All returned questionnaires were analysed using *SPSS*. The Cronbach *alpha* for the questionnaires was 0.881, indicating that the collected data were highly reliable. The results of the questionnaire are shown in Table 3, which can be considered to be students' learning motivation or results (Tough, 1982; Long, 1985).

Table 3: Results of the questionnaire for the ESP courseware for World Heritage

Questions	Mean (STD)	
	Sophomore N=38	Junior N=42
1. The courseware sufficiently improves your knowledge about World Heritage sites.	3.95 (.733)	4.05 (.697)
2. The courseware sufficiently helps in learning English for vocabulary.	3.89 (.798)	4.02 (.604)
3. The courseware sufficiently helps in learning English for listening skill.	4.00 (.771)	4.12 (.670)
4. The courseware sufficiently helps in learning English for speaking skill.	2.55* (.828)	2.95* (.764)
5. The courseware sufficiently helps in learning English for reading skill.	3.74 (.760)	4.00 (.663)
6. The courseware sufficiently helps in learning English for writing skill.	3.03 (.854)	3.38 (.795)
7. The courseware sufficiently helps in learning English for translation skill.	3.55 (.795)	3.79 (.606)
8. The content of the courseware is relevant.	3.55* (.795)	3.79* (.606)
9. The courseware regarding its English is relevant.	3.74* (.642)	4.05* (.623)
10. The hyperlinking of the courseware to the official website of each World Heritage site provides richer learning resources.	4.05 (.804)	4.19 (.594)
11. The online evaluation system of the courseware enhances content learning.	4.08 (.882)	4.07 (.640)
12. The bilingual and multimedia design helps to decrease the learning barrier and promote the learning motivation.	4.08 (.850)	3.98 (.811)
13. The function keys improve navigation.	4.42 (.642)	4.19 (.740)
14. You would recommend this courseware to your friends.	3.97 (.822)	4.02 (.680)
15. The courseware is worth being integrated into curriculum.	4.34 (.781)	4.33 (.612)
The overall average score	3.82	3.93

* $p<0.05$

Seven issues are highlighted:

1. The overall mean for the two groups was higher than 3.82, which indicated that most students selected "Satisfied" as the answer to the questions. Q1 (3.95≤M≤4.05) had higher scores in the two group, meaning that students' awareness or cognition towards World Heritage sites was improved after their self-study with the courseware. This result reinforced the significant achievement made by students in the post-cloze test. Such satisfying achievement might allow students to be willing to recommend this courseware (Q14, 3.97≤M≤4.02) and to feel that it was worth being integrated into curriculum (Q15, M≅4.33).

2. Q3 related to listening skill had a higher score for sophomore students (M=4.00) and junior students (M=4.12). It suggests that the L1 audio component combined with its corresponding paragraph subtitle is similar to subtitled-video, which positively enhanced performance in listening and speaking, and promoted a more efficient comprehension for L2 learners (Herron et al., 1995; Lund, 1991; Rubin, 1994).

3. Q11 had a higher score for sophomore and junior students (M≅4.07). It suggested that the instant online evaluation system enhanced content learning by providing a variety of language activities with different levels of difficulty such as

pronunciation, cloze test, sentence restructuring, listening test, and translation writing. These above results not only met the need of Taiwanese students while taking ESP courses (Lai, 2005) in which were provided integrative language skills including reading, listening, writing, and translation skills, but also reinforced the importance of such an integration of language skills that has been stressed according to theoretical and experiential knowledge (Kumaravadivelu, 2003).

4. Q10 (hyperlinking) also had a higher score in two groups, M=4.05 for sophomore students and M=4.19 for junior students. It implied that computer networking with the Internet has been both a tool for information processing, and for communication through which learners can be provided with more authentic and meaningful materials and interaction outside the classroom for further purposeful, social, cultural and linguistic exploration in real life contexts. The advantage of using such technology through Internet or web-based platforms in the language classroom helps students access online international communities and prepare for cross-cultural interactions which have become increasingly important for success in academic, vocational, or person life (Warschauer & Meskill, 2000; Wang, 2009).

5. Q12 (bilingual and multimedia design) and Q13 (navigation) had higher scores (3.98≤M≤4.42) in the two groups, revealing that a friendly and easy learning interface design should be considered in order to promote learners' motivation, which has been considered one of the key factors in L2 learning. According to Gardner and Lambert (1972), attitudes and motivation have strong relation to language achievement no matter what the learners' aptitude and intelligence may be. Having studied the variables that might affect the strategy use of 1,200 foreign language learners, Oxford and Nyikos (1989) found that motivation had the most powerful influence on the choices of language learning strategies. Thus, strong motivation leads to positive attitudes, and consequently learners can learn well in the process of learning their target language. The original design of the courseware in the study focused on creating a user friendly learning environment which could promote interest and motivation for sustaining learning, especially for learners with low English proficiency who intend to study ESP courses. The positive response here was gratifying.

6. Q2 related to vocabulary had a higher score for sophomore students (M=3.89) and junior students (M=4.02). It indicated that, for students of English as a second language (ESL) in Taiwan, vocabulary is seen as a key factor in improving reading skills, and increasing vocabulary comprehension is seen as the most effective reading strategy (Yi, 1994; Harmon, 1998; Rupley, Logan & Nichols, 1999). Thus, the learning of the content-specific vocabulary needs to be emphasised in the courseware design and during the instruction, which has semantic ties and conceptual relationships with the target content.

7. The scores for speaking (Q4, 2.55≤M≤2.95) and writing (Q6, 3.03≤M≤3.38) skills were lower. The nature of the task given in this study focused on reading comprehension, rather than speaking and writing skills. Thus, according to the teacher's observation within the classroom, students in both groups rarely practised speaking and writing skills during their interaction with the courseware. Such a lowered degree of emphasis and fewer practices probably resulted in the lowest score for Q4 and Q6. It implied that the nature of the skill training in the task had an impact on students' learning needs and strategies.

If compared by group, almost all the means of the junior students for each question were higher than those of the sophomore students. It revealed that the junior students with higher English proficiency more focused on practising English skills and related evaluation activities, and was more satisfied with the content and design of the courseware. A further analysis through the independent samples *t*-test between the junior and sophomore students showed that there was a significant difference existing in Q4 (speaking skill), Q8 (overall content) and Q9 (English content), as shown in Table 3. Since all the means of these three questions for the junior students were higher than those of the sophomore students by 0.24 to 0.40. This result corresponded to Tsai's study (2009) that students with a higher level of English skills were more competent to function in a professional and learner-centered ESP course using the courseware.

In addition to questionnaire results, some students responded to the open ended question, and their suggestions or comments are summarised below.

> It's interesting and challenging to study such an unexpected theme. More World Heritage Sites should be added in the courseware. (Junior student A)

> In addition to the cloze test, other types of tests could be included in the pre- and post-test to make use of and evaluate integrative practices of English skills provided by the courseware. (Junior student B)

> Learning with courseware integration can make learning more effective and less boring. In addition, the courseware provided a variety of learning units and activities such as vocabulary, sentence translation, L1 listening, content knowledge, and online evaluation. I like to keep learning with courseware integration. (Junior student C)

> The courseware is not bad. I felt improved in content knowledge and language practices. (Sophomore student A)

> Chinese translation provided by the courseware made me improved in grammar and vocabulary. (Sophomore student B)

> Although college students need to take learning responsibility on their own and the courseware provides a variety of interactive resources, I prefer teacher-centered instruction which made me more concentrated than self-studying with courseware on the computer. (Sophomore student C)

Similar to the questionnaire results, most of the students who responded to the open ended question had a positive attitude toward the usefulness of the courseware in providing them with increased knowledge and practice with varied English skills. In fact, this was a new experience for students to learn and study under such a learner-centered environment with courseware integration, where they needed to take more responsibility in learning. However, some students still were accustomed to a more teacher-centered instruction possibly due to the cultural influence of Confucianism on Chinese pedagogy, in which teachers provide both knowledge and moral instruction (Jin & Cortazzi, 1998). However, facing new trends toward e-learning either in higher education or later, in the workplace, students should learn to be responsible for their learning. Expanded abilities and more positive attitudes toward e-learning are important new literacy that most educational institutions now urge students to establish, which allow them to be able to conduct lifelong or continuing learning on their own after graduating from school.

Conclusions and implications

The courseware design was based on Mayer's multimedia learning cognitive theory, and the language learning focus drew on Chapelle's suggested criteria for development of multimedia CALL. In addition, learners have the freedom to repeatedly learn and practise at their own pace and need, and meanwhile get instant and positive feedback through the online evaluation system. This multimedia ESP courseware as integrated into instruction corresponds to an increasing awareness in ESP teaching that the curriculum frame integrates three essential fields: content knowledge, language skills and its practices (Zhang, 2007). In addition, such a courseware-supported instruction echoes a generic model proposed by Wang (2008) suggesting three key components: *pedagogy*, *social interaction* and *technology*, for guiding teachers in effective integration of ICT into teaching and learning. The research methodology of the study includes curriculum design and teaching approaches, procedures and assessment that aim at supporting and scaffolding students during the learning process. These teaching strategies, techniques and approaches adopted in this study accords with Wang's pedagogy component. In addition, Wang's social interaction and technology components have been also responded in the multimedia ESP courseware which provided a friendly, non-fearful and flexible online learning environment through which students had a direct and easy interaction with target content and language practices.

Learning languages through technology generally means the use of computers and Internet in classrooms and learning activities in technology-rich instruction, where technology mainly provides two paths to facilitate language learning: software and Internet communications (Hanson-Smith & Rilling, 2007). A model for developing networked ESP courseware for World Heritage Sites has been established in this study through which learners can not only interact with content knowledge and integrative language practices provided by the courseware, but also be exposed to world wide web which includes a vast amount of authentic materials for real life, meaningful communication and learning for learners' exploration and interaction in the target language.

After self-studying with the courseware, sophomore and junior EFL students all made significant progress in the post-test, indicating that learners were able to upgrade their knowledge and cognition under a learner-centered environment with courseware integration. According to the results of the questionnaire survey and the open ended question, the courseware was effective and accessible, and the integration of language skills with different levels of difficulty into courseware was another advantage. In general, junior and sophomore students were satisfied with learning through courseware integration. Junior students with higher English proficiency not only were more focused on practices of English skills and related learning activities, but were also more satisfied with the content and design of the courseware.

In addition, according to the researcher's observation within the class, probably due to students' instrumental motivation to obtain higher achievement for their grade, sophomore and junior students both concentrated on studying the content of the three target sites and interacting with a variety of language practices offered by the courseware. Thus, courseware-integrated instruction combined with task-based learning effectively provided a learner-centered environment in which students were able to actively explore and interact with content knowledge, at the same time

practicing relevant linguistic fluency in order to conduct the cloze test in the post-tasks.

Since the courseware included authentic texts with L1 audio and translation support, narration, practice with integrative language skills, and online tests with instant self-checking, the computer played a role of an adjunct teacher, a peer and a facilitator with which students had had a direct interaction to learn on their own, practise any language skill, receive the questions, and think of the answer. These features met the target need of Taiwanese students taking ESP courses to be able to apply language skills. Thus, students perceived their improvement in content knowledge and language skills, and had a positive attitude toward such a learner-centered ESP instruction by courseware integration. In fact, the fullest collaboration for ESP teaching is often said to be one where a subject expert and a language teacher team teach classes (Johns & Dudley-Evans, 1991). However, such teaming has not been feasible in vocational education in Taiwan for several reasons, such as lack of qualified teachers, difficulties of collaboration or relevant curriculum design. Students' positive attitude toward courseware integration into ESP instruction in this study implies that the well-structured courseware can be an instructional tool to support an approach to ESP in higher technical education in which students' English skills and content knowledge can be promoted.

Due to the limited time of the courseware trial, only vocabulary comprehension was discussed in this study. Thus, more classroom-oriented research with different types of tests such as listening, reading-to-writing or Q&A tests, is required to determine more impacts of such courseware integration and gain more insights: (1) Although the development of ESP courseware is an interdisciplinary task and creating teacher-customised courseware incorporated into a regular classroom needs lots of teachers' willingness and contribution in content design and curriculum planning, the courseware integration into curriculum is still worthy being conducted, to further study and understand whether or not such a potential ESP instruction could be a possible solution to the problems encountered in the ESP development in Taiwan, and also to analyse and discuss learning effectiveness, attitude and strategies of learners with different educational and working backgrounds toward ESP instruction with courseware integration; (2) Through the collaboration with other departments and industries, the development of ESP courseware can be expanded to more professional subjects in order to enhance the professional and English skills of learners in different fields.

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