Study on ESP Courseware Integration into Instruction in the Technological Context

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Abstract:

The study reports on integrating self-developed ESP (English for specific purposes) courseware into a self-study and elective course "English Reading for Technology" offered for junior students in the department of applied foreign languages (AFLD) in Taiwan two hours per week for six weeks. A CAI (computer-aided instruction) approach, combined with a TBL (task-based learning) approach, was adopted. Evaluation of this integration is based upon data from a variety of pre- and post-tests including cloze, listening, writing and Q&A. Meanwhile, a traditional teacher-centered F2F instruction was conducted as a control group. The learning effectiveness in most of posttests under both instructions has been significantly improved. Students under the instruction with courseware integration made as much, even better, progress as those did under the traditional F2F instruction, suggesting that the well-structured courseware offered a potential solution to problems in the development and expansion in frequency of ESP courses in Taiwan by playing the role of an adjunct teacher and facilitator through which students could practice language skills and learn content knowledge. Most students were satisfied with practices for learning English skills and professional knowledge provided by the courseware, and had a positive attitude toward ESP courseware integration into instruction. In addition, students used reading strategies in a moderate degree, and the most-commonly used reading strategies were cognitive, memory, and compensation, but social-affective strategies were least frequently employed. It was found that the nature of the skill training given in the task had an impact on students' learning strategies.

Keywords: Interactive learning, courseware integration, task-based learning, English for specific purposes, reading strategy

1. Introduction

With the rapid development and fierce competition of business and industry, business communities around the world have deemed English language skills as an important tool to compete in the global economy. The competence in English also plays a pivotal role in the success of one's career. One of the goals of foreign language education identified by the Ministry of Education of Taiwan for vocational educational programs is to provide students with the foreign language ability and advanced professional knowledge necessary to succeed in the job market. The Ministry emphasizes that the principles for curriculum design of technical and vocational universities must

be based on the needs of industry and that any curriculum design should mainly focus on making students competent, skilled and knowledgeable professionals. This development trend has caused ESP instruction to be more greatly-emphasized at technical universities in Taiwan (Tsai, 2009; Tsai & Davis, 2008).

However, there are some problems in the development of ESP courses in Taiwan. Lai (2005) investigated the relationship of the English proficiency level of students in four universities of technology, their needs when taking ESP courses, and their expectations of an ESP teacher. Significant findings include: (1) learners' main reasons for taking ESP courses are their relevance for future jobs in business or technology; (2) sufficient qualified teachers, authentic materials and specific knowledge were not provided; (3) the target need of students taking ESP courses is to be able to apply language skills such as listening, speaking, reading and writing.

With recent progress in information technologies, educational technologies provide learners and instructors with numerous advantages in the areas of contextual, active, self-paced and individualized learning, and automation. Courseware, also called instructional or educational software, is widely used in higher education as an integral part of the courses. The integration of courseware or multimedia into instruction has become a very effective tool for learning (Roblyer, 2003; Rosenberg, 2001). Tsai (2010; 2011) reported on the development of ESP multimedia courseware for oral presentations, and its integration into self-study learning and elective courses for students in Taiwan, as one solution to problems in ESP courses. The results indicated that after students' self-study for six weeks, EFL (English as a foreign language) or non-EFL students' learning effectiveness and satisfaction with the courseware integration were significantly improved. Such student improvement suggests that the development of ESP courseware and its integration into instruction could be a useful way to overcome problems caused by lack of ESP-trained instructors, because it can provide another form of team-teaching to help Chinese students repeatedly practice their English skills with L1 (first-language: English) audio through the courseware, while learning professional content. In addition, students who were participating in learner-centered instruction with courseware integration could make as much progress in preparing speech texts as those did under traditional F2F instruction (Tsai, 2010).

Although courseware development and its application in classroom lectures is becoming more greatly emphasized, 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). This trend is possibly due to the ability 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. The effectiveness of these teacher-customized instruction tools has not been fully realized or studied in ESP courseware development in Taiwan, which is an interdisciplinary task that emphasizes coordination and integration of subject knowledge, language learning, and multimedia and information technologies.

Besides, language learning strategies are specific thoughts, behaviors, or actions that learners use for a more self-directed and more comprehensive, easier, faster, and more effective learning (O'Malley & Chamot, 1990; Oxford, 1990). According to Oxford (1990), language learning strategies include six categories and are divided into two parts: direct and indirect, three categories for each part. Direct strategies include memory strategies related to store and retrieve aspects of the language or new information (grouping, applying imagery), cognitive strategies related to use the language and to understand how it works (practicing, analyzing and summarizing), and compensation strategies related to use the language despite gaps in knowledge (guessing and avoiding uncertainty). On the other hand, indirect strategies consists of metacognitive strategies to help learners control their cognition and coordinate their learning process (planning, organizing and evaluating), affective to help learners regulate their emotion, motivation, and attitude (positive self-talk and self-rewarding), and social strategies to work or interact with others to get input and practice (cooperation with peers). These six strategies are interconnected, and interact with and support each other.

Studies on learners' use of language learning strategies mainly aim at understanding how learners conduct learning on their own and how teachers can help them. Based on the strategy inventory for language learning (SILL) assessment designed by Oxford (1990), some studies have revealed that the use of language learning strategies is related to improve or facilitate language proficiency and achievement. However, there are few studies to assess learning strategies of college students while studying ESP courses.

2. Purpose of the study

The aim of the current study is to understand whether or not students can benefit from integration of a self-developed ESP courseware into another elective course "English Reading for Technology" in which computers play a central role as the means of information delivery, as a way to help students enhance their content knowledge and improve relevant linguistic fluency through their direct interaction with the courseware. Students' learning satisfaction and reading strategies toward such a learner-centered instruction are also discussed. In addition, in order to probe the learning effectiveness through ESP instruction with courseware integration, a traditional teacher-centered face-to-face (F2F) instruction was conducted for a further comparison.

3. Instructional design

The courseware integration was implemented in an elective course "English Reading for Technology", offered for two hours per week for six weeks. A CAI approach (Warschauer, 1996) combined with 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 cloze, listening and assay-writing tests in the Pre-task and Post-task phases respectively before and after their study two target articles embedded in the courseware, *Economic*

Engine and *Hi-tech Manpower* that had been edited by an experienced English-native instructor majoring in linguistics. In addition, a Q&A test including simple questions of briefly explaining or describing students' comprehension toward text content was given in the Post-task phase. These pre- and post-tests lead to understand students' learning effectiveness.

During the Pre-task phase, students had to conduct a variety of pre-tests such as cloze, listening and assay-writing tests through which they not only previewed the task objective, but had to think ahead about how to do the task and plan the knowledge and language they would need. Then, based on the feedback of these pre-tests, student acquired a better understanding about what they would be expected while completing the tasks. In the During-task phase, the students self-studied with the courseware 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, in addition to a variety of post-tests, students were asked to complete the questionnaires of satisfaction and of reading strategies to provide some notion of their perceptions of learning effectiveness and behavior after their self-study with courseware in the previous phase. Then, based on students' actual performance and their questionnaire reports, the teacher provided written and oral feedback including language forms that students were using, problems that students had with language and organization, and progress that students made. The methodology of this study was divided into two phases, *Description of the instructional material*, and *Courseware integration into instruction*, and are discussed in that order.

Fig 1 Bilingual buttons design for selecting sections and their learning topics and unit shown on the main page of the courseware

3.1. Description of the instructional material

The integrated courseware is based on Mayer's multimedia learning cognitive theory (Mayer, 2001; 2005) and its language learning focus draws on Chapelle's suggested criteria (1998) for

development of multimedia computer-assisted language learning (CALL). The courseware includes authentic texts with L1 audio and translation support, narration, practice of language skills, on-line tests with instant self-checking; graphical images are all presented, both temporally and spatially, as shown in Fig. 1. They are implemented in learner-paced segments so that students can control their learning pace and educational experience for repetition, deliberate practice and self-evaluation with the courseware.

This layout aims 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, they are implemented in learner-paced segments so that students can better control their learning pace and educational experience for repetition, deliberate practice and self-evaluation with the courseware. Such a layout of multimedia learning with narration is intended to promote a better transfer and performance in retention tests by providing learners with verbal interaction and visual aids which help increase their Zone of Proximal Development (Vygotsky, 1962). Thus, the well-structured content of the courseware plays a scaffolding role enable learners to construct and promote their language fluency and skills in problem solving for the task requirement.

The content of the ESP courseware is divided into three sections: *Articles for Technological Industries*, *Conversation in business contexts*, and *Terminology*. Each section includes several topics with learning units and on-line tests. Two target articles of this study are included in the first session. The operation mode of learning content knowledge and practicing language skills are explained as follows: After any paragraph of the English text is touched by the mouse, the color of the paragraph becomes blue, shown in Fig. 1. The paragraph is being spoken in English with L1 audio as learners click on left button of the mouse. This allows learners to practice English reading skills, and helps improve the learners' pronunciation and listening ability. Such a subtitled-multimedia courseware with L1 audio is similar to subtitled-video, which positively enhances performance in listening and speaking, and promotes a more efficient comprehension for L2 (second language) learners (Herron, Morris, Secules & Curtis, 1995; Lund, 1991; Rubin, 1994). This multimedia message with words presented with spoken language corresponds to Mayer's modality and multimedia principles, which facilitates learners to construct verbal and visual cognitive representations and integrate them. After clicking the right button of the mouse, the Chinese translation and explanation of the paragraph will be simultaneously given in a pop-up window shown near the paragraph. This design corresponds to Meyer's temporal and spatial contiguity principles. In addition, learners can use the recording system offered by Microsoft Office to record their pronunciation, which allows learners to practice their English speaking skills.

In addition, an on-line instant evaluation system includes several language tests of varying difficulty, ranging from cloze, sentence restructuring, listening tests to bilingual translation writing (Chinese to English, and English to Chinese). This system is provided for learners to practice integrative English skills, as shown in the right-top of the learning window in Fig 1. When any test

is selected, all the questions in the test are randomly chosen by the program for learners to practice on. In addition, all these learning activities are combined with an instant self-checking system 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 bell-button shown at the end of the question, which allows learners to find the right answer. This learner-centered cue design will reduce cognitive load and learning difficulty and help 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). An example of the listening test is shown in Fig 2.

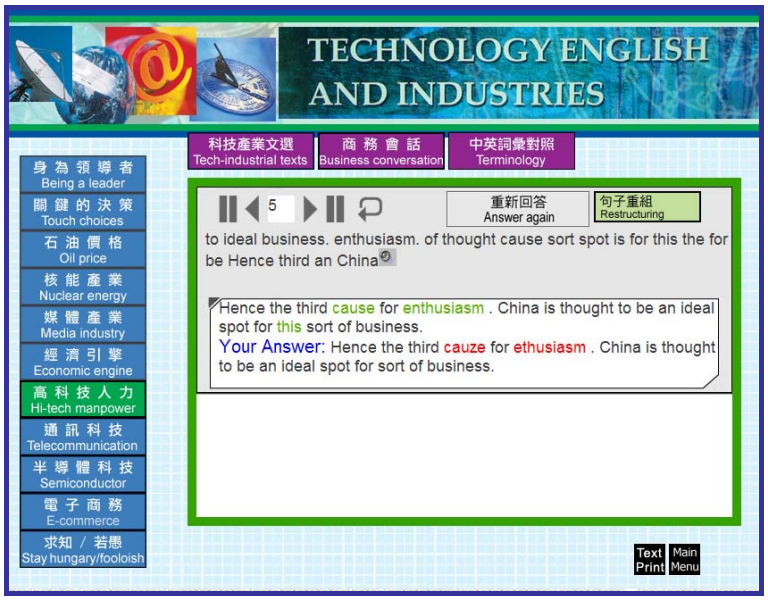

Fig 2 The self-checking system for the listening test: the incorrect part of the learners' reply is shown in red, and its reference answer is in green.

3.2. Courseware integration into instruction

The courseware was implemented in an elective course "English Reading for Technology" for junior AFLD students in a technical university, offered for two hours per week for six weeks. The nature of the course mainly focused on vocabulary, reading, listening and comprehension which are respectively related to learners' input technique and output assessment of the tasks given in this study. The design of the course is as follows:

(1) *Target Audience:* The program was selected by 36 AFLD junior students whose English proficiency was determined by a simplified on-line TOEIC-like test in the Pre-task phase. The TOEIC-like test included three test units with a total score of 445: multiple choice questions and answers about sentence patterns, a short oral discussion to assess listening skills, and a set of reading comprehension questions to provide understanding of their English proficiency,

especially in listening and reading which are two main input channels for learning (Chen, 2007; Chiu, 2006). In order to probe the effectiveness of the instruction with courseware integration, a traditional teacher-centered F2F instruction was implemented as a control group (F2F group) and taught by an experienced full-time EFL instructor of the department. 46 junior AFLD students took this course, and also completed the same on-line TOEIC-like test, and all the pre- and post-tests in the different task phases as those students did in the CWI group with the courseware-integrated instruction.

(2) *Learning context:* For the instruction with courseware integration, the course was conducted in the multimedia laboratory. 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. The two target articles embedded in the courseware are *Economic Engine* and *Hi-tech Manpower* with 337 and 244 words for each. These two articles are related to China's amazing development in economic and manpower in technological industries.

(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 practicing 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. For the F2F instruction, the same learning content was used and the teacher led students to read the target content, and explain the sentence structures and give Chinese translation.

(4) *Assessment:* A variety of the pre- and post-tests including cloze, listening, and assay writing, were respectively conducted in the Pre- and Post-task phases to provide students' learning performance or evidence. The same questions extracted from the two target articles were given in the cloze and listening tests, 15 blanks to be filled in and 8 sentences with 129 words to be listened to respectively. Besides, a simple Q&A posttest with 7 questions was given to understand students' retention and comprehension. The two assay writings conducted before and after studying the two target articles were similar: *The Impact of China's Rising on Taiwan* and *The Impact of China's Rising on Current Global Development*. In addition, all the students' written texts were collected, analyzed and measured by the Computerized Propositional Idea Density Rater (CPIDR) which is a computer program to determine the propositional idea density (P-density) of an English text automatically on the basis of part-of-speech tags (Brown, Snodgrass, Kemper, Hermen and Covington, 2008; Covington 2007). P-density can be approximated according to the number of verbs, adjectives, adverbs, prepositions and conjunctions, divided by the total number of words in the text. It relates to the understanding and remembering of texts and some experiments have related idea density to readability, memory, and the quality of students' writing (Kintsch, 1998; Takao, Prothero

and Kelly, 2002; Thorson and Snyder, 1984). These tests were considered as a quiz which score was included in their grade. It allows for a higher instrumental motivation that is generally characterized by the desire to obtain something practical or concrete from the study of a second language (Hudson, 2000) such as meeting the requirements for school graduation or achieving higher performance.

(5) *Questionnaire survey*: The evaluation of the instruction with courseware integration was also gained by a questionnaire of satisfaction (QF) which includes 15 questions and was administered at the end of the posttest in the Post-task phase. QF1 concerns improvement for the target field, QF2-QF7 concern the suitability for practice of English skills including vocabulary, listening, speaking, reading, writing and translation, QF8 and QF9 are respectively related to the relevance of the content knowledge and English, and QF10 and Q11 respectively concern courseware layout and instant on-line evaluation system. QF12 and QF13 respectively correspond to motivation promotion through the bilingual and easy interface design of the courseware. QF14 is related to satisfaction of students' direct self-study with courseware. QF15 is related to students' recommendation for the courseware. responded to each item of the satisfaction questionnaire using 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 analyzed through SPSS.

(6) *Reading strategies*: Reading strategies play an important role in helping learners become excellent and proficient readers. Based on results of related research in learning strategies (Chen & Cheng, 2009; O'Malley & Chamot, 1990; Oxford, 1990; Mokhtari & Sheorey, 2002), a reading strategy questionnaire with 5-point Likert scale was administered to elicit students' overall and individual thoughts and behaviors while studying such a courseware-integrated ESP course. A total of 39 questions in the questionnaire were divided into five types of reading behaviors such as memory (questions 1 to 8), cognitive (questions 9 to 18), compensation (questions 19 to 24), metacognitive (questions 25 to 31), and social-affective (questions 32 to 39).

4. Results and discussion

4.1 Students performance in the pre- and post-tests

Since vocabulary knowledge and English proficiency are important factors to be considered for reading comprehension and its strategy use, students' background of the CWI and F2F groups was measured and determined in the Pre-task phase, as shown in Table 1, including students' mean score of the on-line TOEIC-like test and the mean vocabulary count they selected while skimming the two target articles for the first time. Through the SPSS analysis of independent sample *t*-test, there is no significant difference in the TOEIC-like score and vocabulary count between students in

both groups. It implied that students in the CWI and F2F groups had equivalent English proficiency and text difficulty in the beginning of the course.

The evaluation and evidence of the both instructions was seen through completion of a variety of pre- and post-tests respectively assigned in the Pre-task and Post-task phases. The results are given in Table 2. Since not all the students attended this course every week, the number of the students who conducted the pre- and post-tests was various. For the both instruction, the SPSS analysis through the paired sample *t*-test indicated that most students in both instructions made some significant improvement or progress in the posttests, especially in cloze, listening, and Q&A tests. Such a significant improvement made in the posttests suggests successful evidence of the both instructions, under the teacher-centered F2F instruction and the learner-centered instruction with courseware integration. Detailed results and discussions are explained as follows:

Table 1 Students' background in the both groups

Group \ Items	Number of all students	Mean of simplified TOEIC-like test	Vocabulary count
CWI	36	192.0	13.7
F2F	46	198.6	12.3

Table 2 Students' mean performance in the pre- and post-tests for each task

Test \ Task		CPIDR analysis of writing			Cloze	Listening	Q&A
		Idea count	Word count	P-density	Mean percentage of giving right answers		
CWI Group	pretest	107.9 (N=33)	202.8	0.533	44.0% (N=33)	59.8% (N=29)	
	posttest	128.0** (N=38)	238.8**	0.536	84.3%* (N=31)	84.2%** (N=40)	33.7%** (N=28)
F2F Group	pretest	114.5 (N=36)	216.4	0.527	38.7% (N=35)	51.4% (N=31)	
	posttest	103.5 (N=34)	196.3	0.530	73.5%* (N=39)	80.1%** (N=38)	22.6%** (N=36)

N: number of students who conducted the test

* (p<.05) and ** (p<.01): significant difference in students' performance between the pre- and post-tests of the tasks for each group

4.1.1 Assay writing by CPIDR analysis

The SPSS analysis through the paired samples *t*-test for the idea count, word count and P-density of students' essay writing in the pre- and post-tests revealed that a significant difference exists in idea count and word count (p=0.00<.01) between the pre- and post-writing of the CWI

group. This result indicated that students in the CWI group wrote more and expressed more ideas after studying the two target articles. However, P-density related to writing quality for both groups has not been improved. In general, writing requires some conscious mental effort and is considered as the most difficult and challenging task among four language learning skills. While composing an article, learners not only need to think up and organize their idea, but also transform them into meaningful text in English. Thus, it was a tough task to ask students to show significant performance during such a short period. Besides, since the analysis of students' speech texts by CPIDR is just a simple and quick measure of lexical proficiency, a detailed analysis can be further conducted to provide insight into deeper, cognitive measures of L2 (second language) writing lexicons such as the development of word senses and lexical network, which could lead to a better understanding or awareness of how L2 learners process and produce lexical acquisition.

Compared by group, an SPSS analysis through the independent samples *t*-test revealed that there was no significant difference in idea count, word count and P density in the pre-writing between the both instruction, but students in the CWI group had a significantly better performance in idea count and word count (p=0.00<.01) of the post-writing than those of the F2F group.

4.1.2 Cloze, listening and Q&A tests

The ability of comprehending vocabulary and content is required to conduct the cloze and listening tests. Before studying the two target articles, most students were not familiar with the context and vocabulary of the articles so that their mean percentages of giving right answers were low, 44.0% and 38.7% in the pre-cloze test, and 59.8% and 51.4% in the pre-listening test for the CWI and F2F groups respectively. Through an independent sample *t*-test, it indicated that students of the CWI group had a significantly better performance in the pre-cloze and pre-listening tests than those of the F2F group (p<.05).

After six-week's study, students' performance in the post-cloze and post-listening tests has been significantly improved up to 73.5-84.3% for the both instruction, as shown in Table 2. In addition, a further SPSS independent sample *t*-test indicated that students of the CWI group with better performance in the pretests still kept a higher percentage of giving right answers, especially having a significantly better performance in the post-cloze test and the Q&A test than those of the F2F group. However, the both groups had a low percentage of giving right answers in the Q&A test, only 22.6% and 33.7% for the CWI and F2F groups respectively. It suggested that students' ability of text comprehension by writing related responses in English still needs to be improved.

In general, students made a significant progress in most of post-cloze, post-listening and Q&A tests after 6 weeks' learning either under students' self-studying with courseware integration or under the teacher-directed F2F instruction without courseware integration. These results indicated that students who were learning via learner-centered instruction with courseware integration could make as much progress as those did under traditional F2F instruction. In addition, based on

students' learning effectiveness compared by group, students of the CWI group even showed a better performance in most post-tests.

According to the researcher's observation within the class, it is possibly due to the fact that students in the learner-centered CWI group were more concentrated and spent more time studying the content of the two target articles and interacting with a variety of language practices offered by the courseware than those in the F2F instruction in which students learned only by listening to what teachers provided and taught. Such a learner-centered interaction is an advantage of the instruction with courseware integration which offers a direct, flexible and friendly learning environment in which learners can study content knowledge or repeat various language practices based on their learning need, interest and pace through computers.

4.2 Questionnaire of satisfaction with the courseware-integrated instruction

The returned questionnaires were analyzed through SPSS. The Cronbach alpha reliability for the questionnaires was 0.894, indicating that the collected data were highly reliable. The results of the questionnaire are listed below in Table 3.

The results showed the overall mean of consensus is 3.74, and the means of students' cognition improvement in content knowledge (QF1) and of their recommendation (QF15) both are 3.91, close to 4. These results imply that most students had a positive attitude to such a learned-centered self-study instruction with courseware integration. As the satisfaction questionnaire administered by users can be considered to be their learning motivation or results (Long, 1985; Tough, 1982), five features are highlighted:

(1)The highest score for QF2 (M=4.16, vocabulary improvement) revealed that vocabulary is seen as a key factor in improving reading skills, and increasing vocabulary comprehension is an effective reading strategy (Yi, 1994). Thus, it suggested that it is necessary for instructors to teach students content-specific vocabulary, which has semantic ties and conceptual relationships with the target content. It allows students to have a better understanding of lectures, texts and class discussions.

(2)The other question with the highest score was QF3 (M=4.16, listening improvement), probably due to the fact that listening skill, as vocabulary learning, is also the focus and emphasis of the curriculum requirements in this study. This result indicated that the L1 audio component combined with its corresponding paragraph subtitle gave a favorable and positive learning environment for L2 students to promote more efficient comprehension.

(3)The questions concerning the bilingual and multimedia design (QF12, M=4.00) of the courseware and its user-friendly navigation (QF13, M=4.12) also had higher scores, implying that a user-friendly multimedia interface design of the courseware should be considered first, especially for ESP courseware with professional or technical content because it can add pedagogical value to the application and promote learner's 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 how the learners' aptitude and intelligence may be. Moreover, strong motivation leads to positive attitudes with which learners can have a better effectiveness in the process of learning their target language. The original design of the courseware was focused on creating a user-friendly learning environment which could promote interest and motivation for sustaining learning. The positive response was confirmed here.

(4) QF4 (speaking improvement, M=2.31) had the lowest score and lower than 3, probably due to students' few practices. According to the teacher's observation within the classroom, students rarely practiced speaking skills during their interaction with the courseware. Such a lowered degree of stress and fewer practices in the speaking skill probably resulted in the lowest score for QF4. Besides, another lower score for QF6 (writing improvement, M=3.12) probably resulted from less progress that could be made in such a productive skill which is generally more difficult to learn than receptive skills like listening and reading (Ali, 2007; Blanchard, Mason, & Daniel, 1988; Greenfield, 2003). The above result implied that the nature of the skill training given in the task had an impact on students' learning needs and behavior.

(5) A higher score for QF14 (self-study with the courseware integration, M=4.00) indicated that most students were accustomed to such a learner-centered instruction with courseware integration. Facing new trends toward e-learning either in higher education or later, in the workplace, students need to keep learning how to take more responsibility for their learning, and this will especially be the case with learning with multimedia courseware. Courseware integration requires learners to engage more actively in the cognitive processes of selecting, organizing, integrating and applying what they acquire in the learning process. Thus, expanded abilities and more positive attitudes toward e-learning are important new literacies that most educational institutions now urge students to establish. This will allow them to be able to conduct lifelong or continuing learning on their own after graduating from school.

The first three features in color, audio, and translation mentioned above 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. Besides, a higher score for QF11 (M=3.81, on-line evaluation system with instant self-checking function) suggested that repeatedly practicing on-line integrative language skills with written English texts and its L1 audio offered by the courseware meets Chapelle's second suggestion which concerns linguistic input provided through either written or aural language and modified by several forms such as repetition, simplification through restatements, non-verbal cues, decreased speed, reference materials, and change of input mode. Moreover, the instant self-checking function of the on-line evaluation system corresponds to Chapelle's suggestions regarding the provision of opportunities for learners to notice their errors and correct their linguistic output.

Table 3 Results of students' questionnaire of satisfaction

	Mean (STD)
QF1. The courseware improves your cognition in content knowledge.	3.91 (.641)
QF2. The courseware is sufficiently helpful to improve vocabulary.	4.16 (.677)
QF3. The courseware is sufficiently helpful to improve listening skills.	4.16 (.628)
QF4. The courseware is sufficiently helpful to improve speaking skill.	2.31 (.693)
QF5. The courseware is sufficiently helpful to improve reading skills.	3.84 (.677)
QF6. The courseware is sufficiently helpful to improve writing skills.	3.12 (.751)
QF7. The courseware is sufficiently helpful to improve translation skills.	3.53 (.950)
QF8. The content knowledge of the courseware is relevant.	3.75 (.718)
QF9. The English content of the courseware is relevant.	3.72 (.729)
QF10. The layout of learning units in the courseware is relevant.	3.91 (.818)
QF11. On-line evaluation system with instant self-checking function enhances your learning.	3.81 (.931)
QF12. The bilingual and multimedia design of the courseware help decrease the learning barrier and promote the learning motivation.	4.00 (.842)
QF13. The function keys improve navigation	4.12 (.660)
QF14. You are accustomed to this instruction with courseware integration.	4.00 (.842)
QF15. You like to recommend this courseware to your friends or classmates.	3.91 (.734)
The overall average score	3.74 (.768)

4.3 Students' Reading strategies

In order to understand students' reading strategies while studying such an ESP course with courseware integration, a reading strategy questionnaire was administered in the Post-task phase. Based on the learning-strategy taxonomy of Oxford (1990), a reading questionnaire with 39 questions divided into five types of reading behaviors such as memory (8 questions), cognitive (10 questions), compensation (6 questions), metacognitive (7 questions), and social-affective (8 questions), was employed (Chen & Cheng, 2009). The overall reliability coefficient of the

questionnaire of reading strategies was 0.871, suggesting that this questionnaire was reliable to measure students' use of reading strategies. There were 32 junior AFLD students who completed the questionnaire of learning strategy.

The mean of the overall strategy was 3.46, meaning that students used reading strategies in a moderate degree. The reading strategies that students used more frequently were cognitive (M=3.65), memory (M=3.63), and compensation (M=3.52), but social-affective strategies (M=3.06) were least frequently employed, as shown in Table 4. These results correspond to previous studies that in general, for EFL students in Taiwan, cognitive and compensation strategies were most-commonly used, and social-affective strategies were least-frequently used (Cheng, 2009; Chiu, 2007; Ho, 2007).

Higher use of memory strategies was found in this study, probably due to the fact that vocabulary learning and listening training were emphasized within this ESP course in which students' memory ability was required to complete a variety of cloze and listening tests in the Pre-task and Post-task phases. Besides, the learner-centered ESP instruction with courseware integration had fewer opportunities for students to work or interact with their partners or peers to get input and practice. Thus, the lowest use of social-affective strategies was found in this study. In fact, this least-frequent use of social-affective strategies is generally observed for Asian learners due to the cultured-conditioned reason (Chen and Cheng, 2009; Polizer and MacGroarty, 1985) that they apparently employ fewer social acts or learning behaviors of having a language partner or asking for help than Western learners. More memory strategies and few social-affective strategies observed in this study also imply that the nature of the skill training assigned in the task has an impact on students' learning strategies.

Table 4 Result of overall and specific types of reading strategy use

Strategy \ type	overall	memory	cognitive	compensation	metacognitive	social-affective
mean	3.46	3.63	3.65	3.52	3.38	3.06

Table 5 Result of Pearson correlation among the overall and specific types of reading strategy use

Strategy type	overall	memory	cognitive	compensation	metacognitive	social-affective
overall		.687(**)	.839(**)	.710(**)	.738(**)	.719(**)
memory			.411(*)	.420(*)	.433(*)	.307
cognitive				.656(**)	.598(**)	.475(**)
compensation					.492(**)	.241
metacognitive						.376(*)
social-affective						

* :$p<.05$); **: $p<.01$

In addition, a Pearson correlation analysis indicated that each strategy type was significantly correlated with the overall strategy use, as shown in Table 5. Moreover, a significantly positive correlation was found among most of the five strategy types. It corresponds to Oxford's study (1990) that five types of reading strategies were interconnected, and they support, interact with, and help each other. Cognitive ($r=0.829$, $p<.01$) and metacognitive ($r=0.738$, $p<.01$) strategies were the first two strategy types to have a stronger association with overall strategic behaviors, suggesting the cognitive and metacognitive strategy types were the most representative and influential factors on the choice of strategy. This result echoed the study of Nist and Holschuh (2000) indicating that students mainly counted on cognitive and metacognitive strategies to carry out language learning tasks. The cognitive strategies are considered as the most popular type of strategies with language users (Oxford, 1990), and Wang (2006) indicated that the instruction of metacognitive reading strategies such as planning, monitoring, and evaluating, successfully promoted EFL learners' reading comprehension and their awareness of strategy use. Such preference of the strategy type use was also noted in other studies (Chen and Cheng, 2009; Mokhtari & Sheorey, 2002).

5. Conclusions and implications

In order to understand the effectiveness of the courseware-integrated ESP instruction, a self-developed ESP courseware, based on Mayer's multimedia learning cognitive theory and Chapelle's suggested criteria for development of multimedia CALL, was implemented in an elective course "English Reading for Technology" for junior AFLD students in a technical university for two hours per week for six weeks. Meanwhile, a traditional teacher-centered F2F instruction was conducted as a control group and taught by an experienced full-time EFL instructor of the department. Students under the both instructions completed the same pre- and post-tests in the different task phases. The significant improvement or progress made in the posttests for both instructions not only suggested successful evidence of the courseware design and learning effectiveness with its integration, but also proved that the instruction with courseware integration could make as much, even better, progress as those did under the traditional F2F instruction. Meanwhile, some educational applications about ESP instruction with courseware integration were found:

Firstly, the courseware as integrated into instruction corresponds to an increasing awareness in ESP teaching for technology that the curriculum frame integrate three essential fields: content knowledge, language skills and its practices (Zhang, 2007). After six-week's learning with the courseware, students could have a better comprehension about content knowledge and made improvement in varied linguistic skills such as vocabulary, listening and reading comprehension.

Next, according to the results of the questionnaire of satisfaction, students perceived their improvement in content knowledge and language skills, and were accustomed to and had a positive attitude toward such a learner-centered instruction with courseware integration. Since the courseware included authentic texts with L1 audio and translation support, narration, practices of

integrative language skills, and on-line tests with instant self-checking, the computer played a role of an adjunct teacher and a facilitator with which students had had a direct interaction to learn on their own, practice 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 (Lai, 2005).

In addition, appropriate feedback through using instant self-checking available in the courseware could largely reduce students' pressure, anxiety and fear. If necessary, students could ask for teacher's individual help. Thus, students would be less embarrassed or even more motivated to participate in learning activities in the class. The ESP courseware integration into instruction in this study would be distinguished over conventional education by encouraging students to be more engaged in learning. Such a positive learning environment should be more especially considered for learners with poorer English proficiency in order that their confidence, motivation and engagement could be enhanced for the promotion of language fluency and content knowledge in a less fearful or threatening environment. It is concluded that the instruction with the integration of well-structured ESP courseware did promote students' learning effectiveness and offer a potential solution to problems in the development and expansion in frequency of ESP courses in Taiwan to meet learners' needs in professional knowledge and language skills.

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. Development of ESP multimedia courseware is an interdisciplinary task, and creating teacher-customized courseware to be incorporated into a regular classroom asks a lot from teachers in terms of willingness and contribution to content design and curriculum planning. However, students' positive attitude toward courseware integration into ESP instruction implies that the courseware, incorporating L1 audio with paragraph subtitles and their translations, 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 number of the participants, the correlation of text comprehension ability with students' learning satisfaction and reading strategy use was not discussed in this study. Thus, in order to better determine and understand further impact of such courseware integration, more classroom-oriented research is required to analyze and discuss learning effectiveness, attitude and strategies of learners with different English proficiency, learning achievement, educational and working backgrounds toward ESP instruction with multimedia courseware integration. In addition, through collaboration with other departments and industries, the development of ESP multimedia 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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