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Integration of Multimedia Courseware into ESP Instruction for Technological Purposes in Higher Technical Education

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ABSTRACT

This study reports on integrating ESP (English for specific purposes) multimedia courseware for semiconductor technology into instruction of three different language programs in higher education by using it as a silent partner. It focuses primarily on techniques and tools to motivate retention of under-prepared students in an EFL setting. 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 (computer-assisted language learning). This learner-centered instruction was compared with a traditional teacher-centered one without courseware integration. Evaluation of the instruction was based upon data from pre- and post-tests, and two questionnaires related to students' learning satisfaction and attitude. The results suggested that students in all three programs have benefited from the courseware integration and were satisfied with practices for learning professional knowledge and English skills provided by the courseware. Students in the weekend program of recurrent education who were both older and had greater work experience had a higher achievement on the posttest, showed better self-discipline, participation and motivation, made greater use of the multimedia, and had a better understanding of teaching goals and professional and English content, so that they were more competent in the ESP course using the multimedia courseware. In addition, such a learner-centered instruction with courseware integration was as good as that with the teacher-centered one and can offer a potential solution to overcome current problems in the development of ESP instruction in Taiwan.

Keywords

Improving classroom instruction, Interactive learning environments, Courseware integration, English for specific purposes, Higher technical education

Introduction

Given the new trend of globalization and the internationalization of the workforce, one of the goals of foreign language education must be to provide students with the foreign language ability and advanced professional knowledge necessary to succeed in the job market. This is a mandate identified by the Ministry of Education of Taiwan for technical and vocational education. ESP (English for specific purposes) instruction has accordingly become increasingly emphasized since 2000 at technical universities in Taiwan, the goal of which is to meet the needs of learners who 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).

In business, the semiconductor industry has become one of the most important industries world-wide, and over the last ten years has been offering many job opportunities in Taiwan. Thus, it is important to upgrade the level of knowledge regarding the industry's development and simultaneously improve English skills within the current system of higher education, because the combination will help students gain related abilities, including language skills, for potential future jobs. Many in-service programs in higher education have been established in Taiwan through which adult learners can either get more job-oriented knowledge and skills or achieve self-expectations in learning more (Hsia, 2004). Such a demand provides an opportunity for the development of ESP instruction which is considered to be a learner-centered, content-based approach to teaching/learning EFL (English as a foreign language). However, there is a curious absence of discussion about teaching EFL to adults (Chang, 2004), not to mention adults' learning behaviors and attitudes toward ESP. In addition, 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 universities of technology, their needs when taking ESP courses, and their expectations of an ESP teacher, Lai (2005) found that: (1) learners' main reasons for taking ESP courses are their relevance for future jobs in business or technology, and when these students became less motivated, it was due to ineffective teachers' conducting the subjects; (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. Meanwhile, a recent study by Wu and Badger (2009) on analyzing teachers' practices in the classrooms of maritime English in a Chinese college found that what they call ISKD (In-class Subject Knowledge Dilemma) situations happened when ESP teachers had to deal with subject knowledge with which they are not completely familiar. The subject knowledge being delivered by an effective ESP teacher is an important issue in understanding students' motivation for taking ESP courses.

These above needs can be met to some extent by CALL (computer-assisted language learning) methodologies and materials which rely on the use of interactive multimedia to integrates language skills (listening, speaking, reading, and writing), provide authentic learning experiments, offer learners control over their learning and also focus on the content (Ma, 2007; Tsai, 2010; Warschauer, 1996). Although courseware development and its application in classroom lectures is becoming more greatly emphasized, its design and use have been more focused on courses related to sciences and technology (Azemi, 2008; Jiménez & Casado, 2004; Shamsudin & Nesi, 2006). That is because instructors in these fields have more competent skills and knowledge of multimedia software and programming so that they are less hesitant to convert their lecture notes into an interactive package that can be available to students. Consequently, the effectiveness of these new instructional tools has not been fully realized or studied in ESP which is an interdisciplinary task that emphasizes coordination and integration of learning technical knowledge and English skills. Recently, the effectiveness of CALL tools has been studied in ESP for semiconductor technology in the four-year day-time program (DP) of the AFLD (applied foreign languages department) in a technical University in Taiwan. The initial evaluations found that college students' performance in courses emphasizing courseware was as good as that under teacher-centered instruction (Tsai, 2009).

Purpose of the study

The present study was conducted to understand the effectiveness of ESP courseware integration into instruction for adult learners of two AFLD in-service programs, a four-year night-time program (NP) and a two-year weekend program (WP). The performance, motivation and attitude of students in these two programs were compared to teens or young adults enrolled in DP program. In EFL environments, working with less prepared students needs to focus on techniques that will pique student interest, stimulate a desire for additional learning experiences, and heighten motivation. CALL tools offer that capability. In addition, in order to probe the learning effectiveness through ESP instruction with courseware integration, a traditional teacher-centered instruction was conducted for a further comparison.

Methods

The methodology of this study was divided into two phases, *Description of the courseware structure*, and *Integration of courseware into instruction*, and discussed in that order.

Description of the courseware structure

The structure of the self-developed ESP courseware includes three sections (Tsai, 2009): (1) an overview, in which three introductory topics (*Introduction to Semiconductor*, *Development and Application of Integrated Circuits*) are included; (2) the core, for which seventeen topics with multimedia movies and bilingual texts (English and Chinese) have been designed; and (3) an on-line evaluation system including listening tests and simple questions in multimedia game-like format, combined with an instant self-checking feedback, helps learners test themselves and monitor their learning progress and achievement. Questions have been devised for all topics related to the theories and manufacturing technologies.

Seventeen multimedia movies with their texts are embedded in the courseware to briefly describe related theories and manufacturing processes of the semiconductor technology mainly including atomic structure, introduction to silicon, lattice structure, energy band structure, intrinsic and extrinsic semiconductors, preparation of wafers, thermal oxidation, ion implantation, photolithography, etching, diffusion, and formation of thin film, bipolar diode, solar cells, light emitting diodes and metal oxide semiconductors. An example of a session layout is shown in Figure 1. The English text for each movie was made as brief and as accessible as possible, about 100 words for each movie, in

order to decrease text complexity and its Chinese translation was offered to allow learners a better comprehension. The terminology of the text is highlighted to reduce cognitive load, corresponding to Mayer's signaling principle (Mayer, 2005); the color of the paragraph will change when being spoken, like karaoke style to facilitate learner's pronunciation improvement, reading focus, and listening skills. Such a subtitled-multimedia courseware with L1 (first language: English) audio is similar to subtitled-video, which can positively promote a more efficient comprehension for L2 (second language) learners (Herron et al., 1995). Meanwhile, learners can record his or her voice through the recording program provided with Microsoft Office to practice their speaking skill.

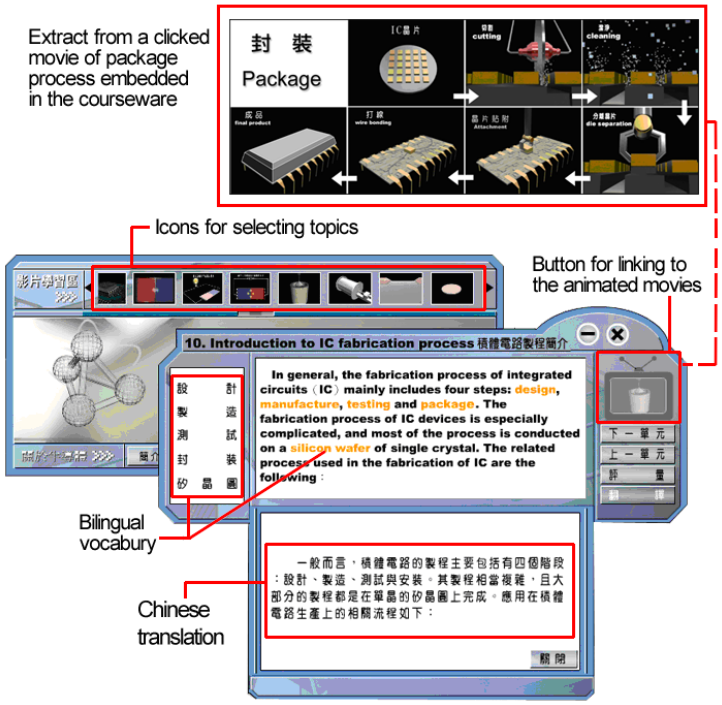

Figure 1: Session layout of package process and the extract from its animated movie

Integration of courseware into instruction

The courseware was implemented as a seven-week module incorporated in a semester-long optional course, ''English for Technology", offered for AFLD students of three different programs in a technical university in Taiwan for four successive academic years. For the instruction with courseware integration, the course was conducted in the multimedia laboratory, and each student was assigned individually to a computer in order that he/she could study by themselves with the courseware. This study adopted a CAI (computer-aided instruction) approach combined with SCLT (sustained-content language teaching) approach where students learn language through the medium of a single content area (Murphy & Stoller, 2001). Two major components are included in SCLT: the first component concerns instruction in a specific subject area for a period of time; the second one is related to instruction in language learning, such as development of English skills, and use of learning strategies. The instruction in the first three years was conducted in a teacher-centered way without courseware integration. A learner-centered instruction for the fourth year was developed by the same teacher, by combining ESP courseware integration with teacher intervention. The curriculum design of the course was as follows:

Goal: the aim of the course was to promote students' English vocabulary and knowledge about semiconductor technology in order to help learners improve their language and professional competence to function within the target community. Meanwhile, based upon data from pre- and post-tests, and two questionnaires, the learning effectiveness and attitude through the instruction with courseware integration was studied.

Subject: the course was taken by AFLD students of the three different programs (NP, WP, and DP). They had studied English for eight years at least: six years in junior and senior high school and two years in college. Their background and job experience were not relate to what was taught in this study. Their background is shown in Table 1.

Teacher: the teacher was the researcher who developed the courseware for the project. The teacher-researcher has a semiconductor technology academic background and has been employed in that field. For the instruction with courseware integration, the teacher played a role of supervising and observing students' behaviors and learning, controlling the schedule, and encouraging students' interaction with the courseware. Based on requests by individual students, the teacher also acted as a coach by giving further explanations, one-on-one, during class.

Teaching content and instruction: For the teacher-centered instruction, the teacher used a textbook (Tsai, 2011) with PowerPoint files to reinforce technological and theoretical aspects of the content that were difficult for students to understand. The courseware as a silent partner through which students took an active role to explore content knowledge and practice related linguistic fluency. In that sense, the courseware was a major medium for delivering and transferring subject content and language practices. The courseware was installed on the server in the laboratory so that students could easily access and learn the target content on their computer. Meanwhile, the teacher also used multimedia 3D visuals built into the courseware to display and explain the subject content. In general, two or three topics were given each week depending on the complexity of the topic. Since the content-specific vocabulary is important to support students' content learning, performance of academic tasks, and use of learning strategies (Donley & Reppen, 2001), in the beginning of learning each topic for both instructions with/without courseware integration, students had to learn the technical vocabulary or terminology from the teacher's preliminary oral explanation, and then studied the text of the topic.

Assessment: a pre- and post-test was conducted to provide students' learning performance or evidence. The questions of these two tests were identical, but rearranged in a different order: ten simple questions asking students to briefly explain or describe terminology or process technologies, such as a p-n diode, photolithography and its process, or package and its purpose. Meanwhile, the pre-test allowed learners not only to preview the task objective, but to think ahead how to do the task and plan the knowledge and language they need which helped stimulate students' engagement.

Questionnaire survey: After seven weeks' instruction with the courseware integration, an internal 5-point Likert-style questionnaire of satisfaction with 14 items was administered to elicit students' responses concerning the suitability of the courseware content and its usage, their perception of how it might support English learning and language acquisition, and their opinions about multimedia-assisted learning, and navigation of the courseware (Tsai, 2009; 2010). A second, external 5-point Likert-style questionnaire with 11 items was administered for both instructions by the academic office of the school in the end of the course to elicit information about the self-discipline and motivation of students, their self-evaluation on learning effectiveness and on teaching methodologies and materials that were delivered in class. Since these two questionnaires were not administered at the same time, students' numbers for each questionnaire were different.

Table 1. Background of the students taking the course with courseware integration

Program	Student number (N)	Mean age	Mean working years
WP (Two-year Weekend Program)	35	36	12.3
NP (Four-year Night program)	30	24	1.6
DP (Four-year Day Program)	64	21	0

Results

Results of students' learning

It was a challenging experiment and an interdisciplinary task to teach a new, practical and technical course in an AFLD department since AFLD students typically have less interest and background in science and technology. 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. Thus, how to promote students' motivation in learning such a technical and professional course remains one of the very important concerns.

Although most students in three programs were not able to answer the questions in the pretest, they made significant progress in the posttest. The means of the students in the posttest are shown in Table 2. It indicated that the effectiveness of content learning was significantly improved after seven-week's participation and learning for both instructions, and meanwhile the mean of the WP students in the posttest was better than those of the NP and DP students. An independent samples *t*-test analysis revealed that no significant difference ($p>.05$) existed in students' posttest scores between the both instructions with/without courseware integration for each program, suggesting that students' learning by using the student-centered instruction with courseware integration was equal to or as good as that with the teacher-centered one.

Table 2. Means of the posttest for the instructions with and without courseware integration (WCI: instruction with courseware integration; F2F: instruction without courseware)

Program	Instruction	students number (N)	Mean of the posttest
WP	WCI	35	81.8
	F2F	42	81.4
NP	WCI	30	73.5
	F2F	66	74.9
DP	WCI	64	76.0
	F2F	180	73.2

Results of students' questionnaire of satisfaction with courseware integration

After seven-week's learning with courseware integration, students responded to each item using a 5-point Likert scale ranging from 1 to 5, including Very Satisfied (5), Satisfied (4), Average (3), Not Satisfied (2), Disliked (1). All valid responses were input and filed for statistical data analysis using one-way ANOVA test that focused on the comparison among the three programs. An acceptable significant level for each statistics was at .05. The choices students selected for each question of the questionnaires were averaged and the standard deviation (STD) was analyzed. The Cronbach alpha reliability for the questionnaire was 0.918, indicating that the collected data were highly reliable. The results are listed in Table 3. As the satisfaction questionnaire administered by users can be considered to represent their learning motivation and effectiveness (Long, 1985; Tough, 1982), some important issues are highlighted from the means of each of the three programs:

1. The mean of consensus was 4.01, indicating that the majority of the students in the three programs are satisfied with the integration of the ESP courseware into instruction. Among all the means of the three programs, there were 9 questions higher than or equal to 4.00 which appeared that students hold the affirmative opinions to these questions.
2. QF1 (teaching with the courseware, M = 4.20) had the highest score. This result meant that the instruction with courseware integration was supported by the students of all three programs. 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. The ESP courseware incorporating L1 audio with paragraph subtitles can be considered as an 'assistant' ESP teacher which not only helps Chinese students of English practice language skills such as pronunciation, spelling, listening, reading, translation and short question writing, but also helps promote students' professional comprehension through their interaction with its multimedia content.
3. The highest score also for QF3.7 (terminology learning, M = 4.20) revealed that, increasing vocabulary comprehension is seen as the most effective and important reading strategy which allows students to have a better understanding of lectures and texts (DeCarrico, 2001), and learning of the content-specific vocabulary should be emphasized in the ESP courseware design and during its integration into instruction, which has semantic ties and conceptual relationships with the target content.
4. QF6 (multimedia assisted learning, M = 4.20) also had the highest score. It indicated that the inclusion of multimedia leads to enhance students' learning, and the layout of the multimedia movies with their brief and

accessible texts played a scaffolding role to help students develop or improve their professional ideas or knowledge that was reinforced by a higher score in QF2 (improvement in professional knowledge, M = 4.02).

5. QF8 (navigation, M = 4.12) had a higher score, suggesting that the user-friendly learning interface design provided guidance into multimedia environment that allowed students to learn leads (Mayer, 2005). Moreover, such a design with multimedia inclusion can not only ease off learning pressure and increase cognitive ability, but also add pedagogical value to the application and promote learner's motivation which has been considered one of the key factors in second language learning (Oxford and Nyikos, 1989).
6. A higher score for QF3.6 (translation, M = 4.09) indicated that translation can help Chinese students of English get a better comprehension of professional knowledge in studying such a technical ESP course, further enhanced by corresponding multimedia movies (QF6) and the teacher's intervention (QF1). Besides, translation of technical terms and texts provided by the courseware can reduce or avoid unnecessary mistakes and misunderstanding from word by word translation.
7. The scores for learning English skills from QF3.1 to QF3.5 are 3.68 - 4.01, higher than the average, or 3. It indicated that the courseware provided enough practices for training integrative English skills, which can meet the need of Taiwanese EFL students in learning this ESP courses (Lai, 2005).

Table 3. Results of the questionnaire of satisfaction with courseware integration

Questions	WP (N=24)	NP (N=22)	DP (N=48)	Mean of the three programs	One-way ANOVA among three programs	
	Mean (STD)				F test	Sig.
QF1.You are satisfied with the teaching with the courseware.	4.58 (.615)	4.05 (.486)	4.08 (.647)	4.20	7.029	WP>NP** WP>DP**
QF2.The courseware improves your professional knowledge in semiconductor?	4.17 (.565)	3.95 (.653)	4.00 (.619)	4.03	.818	
QF3. The courseware helps in learning English for Semiconductor Technology?						
QF3.1 Overall	4.42 (.584)	3.77 (.685)	3.92 (.539)	4.01	8.161	WP>NP** WP>DP**
QF3.2. Listening Skills?	4.08 (.584)	4.00 (.617)	3.69 (.719)	3.86	3.464	WP>DP*
QF3.3 Speaking Skills?	4.04 (.624)	3.55 (.800)	3.56 (.741)	3.68	3.963	WP>DP*
QF3.4 Reading Skills?	4.33 (.565)	3.77 (.612)	3.92 (.710)	3.99	4.830	WP>NP* WP>DP*
QF3.5 Writing Skills?	3.92 (.504)	3.59 (.590)	3.65 (.601)	3.70	2.309	
QF3.6 Translation Skills?	4.42 (.654)	3.91 (.811)	4.00 (.684)	4.09	3.655	
QF3.7 Vocabulary of Technology?	4.46 (.588)	4.09 (.684)	4.13 (.672)	4.20	2.487	
QF4.The professional content of the courseware is relevant.	4.25 (.532)	3.73 (.150)	4.00 (.619)	4.00	4.093	WP>NP*
QF5.The English of the courseware is relevant.	4.42 (.584)	3.91 (.684)	3.85 (.583)	4.01	7.250	WP>NP* WP>DP*
QF6.The multimedia animated movies of the courseware assist learning.	4.50 (.590)	3.95 (.785)	4.17 (.753)	4.20	3.381	WP>NP*
QF7.The evaluation system of the courseware assists learning.	4.29 (.690)	3.77 (.685)	3.90 (.722)	3.97	3.619	WP>NP*
QF8.The function keys improve navigation.	4.25 (.608)	3.86 (.774)	4.17 (.630)	4.12	2.238	
The overall average score	4.30	3.85	3.93	4.01		

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

If compared by programs, WP students who were older and had greater working experience had higher means for all the questions in the satisfaction questionnaire than NP and DP students by 0.22- 0.65. Some studies found (Hsia, 2004; Wang, 2003; Yu, 1998) that learners taking in-service programs at the age of 30 - 40 generally had higher instrumental motivation, which is taken as a desire to use the target languages to attain practical goals, such as getting a job or reading technical materials (Hudson, 2000), so that they showed a better learning satisfaction.

A further analysis through one-way ANOVA among the programs indicated that there was no significant difference between NP and DP, probably due to their similar background. However, a significant difference existed among WP, NP and DP in several questions related such as QF1 (teaching with the courseware), QF3.1 (overall English skills), QF3.2 (listening), QF3.3 (speaking), QF3.4 (reading), QF4 (professional content), QF5 (English content), QF6 (multimedia-assisted learning) and QF7 (on-line evaluation), shown in Table 3. Since WP had a higher posttest score than the other two, the result indicated that WP students with higher achievement were more satisfied with the instruction, and professional and English content provided by the courseware, and made more use of learning activities such as practices of English skills, multimedia and on-line evaluation. Related findings had also been observed in the earlier study: the students with high scores had a better participation, understanding and satisfaction while studying with courseware integration so that they were more competent to learn in such a professional and learner-centered ESP course with the courseware (Tsai, 2009).

Results of the external on-line questionnaire

An external on-line questionnaire with 11 items was administered, including three parts: students' self-discipline and motivation (items 1 and 2), participation and instruction (items 3, 4, 5, 6, 7, 10 and 11) and students' self-evaluation of learning effectiveness (items 8 and 9). A 5-point Likert scale was used and the Cronbach alpha reliability for the questionnaires was 0.951. There were respectively 78 and 271 students for the instructions with/without courseware integration who validly completed the questionnaire. The result is listed in Table 4.

Table 4. Results of the external on-line questionnaire for both instructions with/without courseware integration (WCI: instruction with courseware integration, N=78; F2F: instruction without courseware, N=271)

Questions	Instruction	Mean	STD
E1. I pay attention in class.	WCI	4.46	.502
	F2F	4.59	.522
E2. I always attend the class.	WCI	4.31	.492
	F2F	4.41	.659
E3. What is taught corresponds to the teaching goal.	WCI	4.37	.647
	F2F	4.41	.729
E4. The teaching materials and handouts are rich.	WCI	4.36	.664
	F2F	4.38	.755
E5. The teaching content is relevance.	WCI	4.32	.747
	F2F	4.37	.733
E6. The teacher makes use of the material and gives a systematical explanation.	WCI	4.38	.649
	F2F	4.42	.715
E7. The teacher gives examples or uses auxiliary tools to facilitate learning.	WCI	4.40	.690
	F2F	4.41	.704
E8. I get some professional knowledge and skills.	WCI	4.26	.763
	F2F	4.38	.755
E9. The abilities of thinking, analysis and problem-solving are improved.	WCI	4.35	.735
	F2F	4.41	.693
E10. The preparation and attitude of the teacher is serious and careful.	WCI	4.42	.614
	F2F	4.53	.643
E11. I recommend others to take this course.	WCI	4.37	.705
	F2F	4.49	.688

All the means of the questions for these two instructions were higher than 4, meaning students were satisfied with their individual instruction. Moreover, their means for all the questions were very close to each other. After a further analysis through the independent samples *t*-test, there was no significant difference between the two instructions. Since no significant difference was either found in students' posttest scores between both instructions for each programs, it implied that courseware integration into ESP instruction in this study did play a role of an content and language tutor with which students performed as well as those in a teacher-centered way.

The means of the question E6, E7 and E11 related to the teacher's teaching attitude and strategies in both instructions were higher than 4.38, meaning that the teacher-researcher with academic background and working experience about semiconductor technology had enough ability to handle both language and content, and succeeded in leading students to an effective and meaningful ESP in both instructions by giving good preparation, making use of the material and auxiliary tools and giving systematical explanation. The positive teaching attitude and belief of the teacher was considered as a key factor for success in conducting such a technical and professional ESP course.

Table 5. Results of the external on-line questionnaire for the three programs

Program		WP	NP	DP	Mean of the three programs	One-way ANOVA among three programs	
Instruction	WCI	N=13	N=17	N=48			
	F2F	N=42	N=66	N=163			
Question		Mean (STD)				F test	Sig.
E1	WCI	4.54 (.539)	4.53 (.526)	4.42 (.519)	4.46	.494	
	F2F	4.62 (.519)	4.59 (.514)	4.58 (.498)	4.59	.080	
E2	WCI	4.62 (.741)	4.18 (.747)	4.27 (.598)	4.31	3.499	WP>NP*
	F2F	4.50 (.506)	4.44 (.393)	4.37 (.494)	4.41	.780	
E3	WCI	4.92 (.544)	4.35 (.706)	4.23 (.772)	4.37	6.780	WP>DP** WP>NP**
	F2F	4.60 (.277)	4.47 (.493)	4.34 (.692)	4.41	2.409	
E4.	WCI	4.85 (.547)	4.29 (.728)	4.25 (.801)	4.36	4.625	WP>DP** WP>NP**
	F2F	4.57 (.376)	4.47(.288)	4.29 (.700)	4.38	2.903	
E5	WCI	4.92 (.550)	4.24 (.747)	4.19 (.761)	4.32	5.724	WP>DP** WP>NP**
	F2F	4.55 (.277)	4.44 (.664)	4.29 (.790)	4.37	2.418	
E6	WCI	4.92 (.508)	4.29 (.558)	4.27 (.785)	4.38	6.082	WP>DP** WP>NP**
	F2F	4.71 (.277)	4.56 (.588)	4.29 (.676)	4.42	7.695	WP>DP** NP>DP*
E7	WCI	4.92 (.526)	4.35 (.587)	4.27 (.761)	4.40	5.105	WP>DP** WP>NP*
	F2F	4.67 (.277)	4.55 (.702)	4.29 (.707)	4.41	6.461	WP>DP** NP>DP*
E8	WCI	4.77 (.570)	4.00 (.639)	4.21 (.813)	4.26	4.333	WP>NP*
	F2F	4.67 (.439)	4.50 (.791)	4.26 (.771)	4.38	6.236	WP>DP**
E9	WCI	4.77 (.517)	4.12 (.662)	4.31 (.723)	4.35	3.194	
	F2F	4.69 (.439)	4.48 (1.054)	4.31 (.624)	4.41	5.842	WP>DP**
E10	WCI	4.92 (.484)	4.24 (.519)	4.35 (.703)	4.42	6.126	WP>DP** WP>NP**
	F2F	4.76 (.277)	4.62 (.562)	4.44 (.635)	4.53	5.324	WP>DP**
E11	WCI	4.85 (.544)	4.18 (.523)	4.31 (.754)	4.37	4.071	WP>DP* WP>NP*
	F2F	4.74 (.376)	4.61 (.636)	4.37 (.748)	4.49	6.210	WP>DP** NP>DP*
overall	WCI	4.82	4.25	4.28	4.36		

mean	F2F	4.64	4.52	4.35	4.44

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

In addition, the means of the questions in the questionnaire for each program in both instructions are shown in Table 5, all the means of the questions higher than 4. WP students with better posttest scores had higher means for all the questions than NP and DP students in both instructions. Taking the one with courseware integration into consideration, a further one-way ANOVA analysis indicated that there was no significant difference between DP and NP where students' posttest scores were close to each other, but a significant difference among WP, DP and NP, existing in E2 (attendance), E3 (understanding of teaching goal), E4 (teaching materials and handouts), E5 (relevant content), E6 (teacher's instruction and explanation), E7 (use of auxiliary tools), E10 (teacher's attitude), and Q11 (recommendation), shown in Table 5. These differences revealed that better understanding about learning goal, more students' active participation and more supportive attitude from the teacher has a significantly positive influence on the learning satisfaction and effectiveness of WP students.

In case of instruction without courseware integration, similar significant difference was also found in E6 – E11, especially between adult WP students and college DP students. Threlkeld and Brzoska (1994), studying distance education which is another kind of learner-centered approach, noted that "maturity, high motivation levels, and self-discipline have been shown to be necessary characteristics of successful, satisfied students" (p. 53). Their findings could explain what was found for the better performance of WP students in this study.

Discussion

The ESP instruction in this study was respectively conducted without and with courseware integration to students of three different programs. Although students were satisfied with F2F instruction without courseware integration, some problems were observed: (1) it was difficult for a teacher to apply integrative training in English skills within a class, especially with about 60 students in a class; (2) Even though terminology, principles, and manufacturing processes were introduced, the instruction became boring and inefficient due to students' repeated questions about subject knowledge or its basic chemical or physical principles, rather than about linguistic knowledge.

To remedy the problems mentioned above, integrating courseware incorporating L1 audio with paragraph subtitles and its Chinese translation became a possible solution. During the seven-week's learning process, the computer was a major medium for delivering and transferring content knowledge and language practices, and the courseware played three main roles: (1) Tutor: making the transfer of professional knowledge by providing texts with L1 audio and multimedia movies; (2) Language teacher: providing learners with repeated practices of language skills; (3) Peer-like role with which students can have a direct interaction throughout their learning process. Other beneficial features have been found: First, students were able to pay attention to the input from their direct and individual interaction with the courseware within the classroom. Second, students had more freedom and responsibility to learn at their own pace and need. Meanwhile, it gave more equal participation and opportunity for students to study the target content and practice its related language skills. Third, students felt less shy to ask the teacher for one-on-one explanations, and meanwhile the teacher was more available for such individual requests.

Of course, this integration is not a panacea and has its limitations such as requiring investment of time and money, interdisciplinary collaboration and integration in courseware production. Moreover, it brings no guaranteed results. However, when appropriately implemented, integrating courseware into instruction can offer the means to conduct a more thorough integration of language and content knowledge, and provide students with unprecedented opportunities for autonomous learning.

According to the questionnaire survey, students' satisfaction with practices of integrative English skill reinforced the layout and design of the courseware in language. The integrated ESP courseware in this study met Chapelle's suggestions (1998) for multimedia CALL based on hypotheses about ideal conditions for SLA (second language acquisition). For example, the color change of the paragraph and its audio and Chinese translation can be conducted and provided by just clicking the right or left buttons of the mouse. These features 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 by several forms such as repetition, simplification through restatements, non-verbal cues, decreased speed, reference materials, and change of input mode. This suggestion can be achieved by repeatedly practicing integrative skills with written English texts combined with L1 audio and related multimedia movies offered by the courseware. These types of linguistic modifications are distinct from the materials found on the Web because they hold the potential to provide learners with comprehensible input rather than just input. In addition, the language training offered by the on-line evaluation system of the courseware provide learners with opportunities for comprehensible output which can be conducted either written or spoken by using target language forms to stretch their competence, as mentioned in Chapelle's third suggestion. Besides, the instant self-check function of the online evaluation system allows learners to analyze, recheck, reflect, and identify, and even correct their errors. This design corresponds 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 subject content. Students' learning effectiveness was presented in the results. While the courseware was integrated into instruction, the task assigned in this study focused the learner's achievement on accomplishing a Q&A test through the use of language rather than only on solving problems of linguistic form, as suggested by Chapelle.

Besides, no matter the instruction with or without courseware integration, students had less confidence to express themselves in English. Moreover, they expected that the teacher could explain complicated and unclear parts in Chinese for better understanding. Accordingly, bilingual explanations for difficult or abstruse technical knowledge in English and Chinese was sometimes useful and necessary because teacher's explanation with familiar Chinese technical terms that they had learned before could reduce students' cognitive load and anxiety in subject knowledge and enhance their comprehension in studying such a technological ESP course. Moreover, the teacher with experience of teaching English, academic background and working experience had enough ability to handle both language and content, and succeeded in leading students to an effective meaningful learning. Lai's (2005) survey agree on the importance of having effective ESP teachers who are able to connect to learners with real work experience, provide knowledge related to jobs, exercise English skills, and offer authentic and meaningful materials.

Conclusion

Expanded abilities and more positive attitudes toward e-learning are important new literacy that most educational institutions now urge students to establish. Integrating courseware into instruction within the classroom shifts the teacher-centered learning to student-centered learning and this approach focuses on helping students become autonomous learners who can continue to learn how to communicate, conduct research or present ideas effectively in their life-long or continuing learning after graduating from school. Such students' learning ownership is especially important in an interactive multimedia environment where students have to engage more actively in the cognitive processes of selecting, organizing, integrating and applying what they acquire in the learning process. Meanwhile, the teacher offering instruction with courseware integration needs to play a role of facilitating students' learning process, encouraging and enabling them to study with the courseware to be independent and responsible learners.

The main objective of the ESP course in this study is to help students establish basic knowledge or understanding of semiconductor technology, more emphasizing terminology and content learning. In fact, it is a tough task for ESP teachers to meet and conduct all these requirements within the classroom, especially in teaching more technical ESP courses. Thus, the utilization of instructional tools should be seriously considered, depending on the nature and goals of the courses, to conduct effective and smooth instruction. Based on the constructivist approach, ESP instruction with courseware integration in this study allowed students to interact with the content, to explore and construct vocabulary and meanings. Such individualization in learning enhanced by technology has been proved in this study. Of course, more classroom-oriented research is required to determine the full impact of such courseware integration and gain more insights.

According to the results of the posttest and students' responses to the internal questionnaire of satisfaction and the external on-line questionnaire of self-evaluation, the performance, motivation and attitude of adult students have

been analyzed and were compared with those of college ones. Meanwhile, the learning effectiveness through the instruction with ESP courseware integration was also studied. In conclusion, some important findings include these:

1. Like college students, adult students of the in-service programs were satisfied with the courseware which provided professional knowledge with practices of English skills including vocabulary usage, pronunciation practice, speaking opportunities, reading and translation practice, listening practice and short answer writing exercises. It suggested that the courseware played the role of an adjunct content and language teacher.
2. Professional knowledge and English skills of students in all three programs were improved from the learner-centered instruction with courseware integration. Moreover, students' performance in the posttest was as good as that in the teacher-centered instruction.
3. Multimedia movies embedded in the courseware supported a friendly multimedia-assisted environment which acted out real-life experience so that the transfer of information and knowledge to learners can be facilitated and promoted both visually and auditorily. Furthermore, such multimedia inclusion combined with user-friendly navigation design enhanced knowledge transfer for students and promoted learner's motivation which led to a better learning satisfaction and effectiveness.
4. Students in the WP program who were older and had greater working experience performed better in the posttest than those of the NP and DP programs in both types of instruction with/without courseware integration. The questionnaire results indicated that WP students showed better self-discipline, participation and motivation. Meanwhile, they made more use of multimedia and had a better understanding of teaching goal and professional and English content so that they were more competent to learn such a learner-centered technological ESP course with courseware integration.
5. The team instruction combining well-designed ESP courseware and subject teacher's intervention did offer a potential solution to problems in the development of ESP courses in Taiwan to meet learners' needs in professional knowledge and integrative language skills. In case fullest collaboration for ESP teaching is not feasible, more technical ESP courses can be taught by subject teachers with experience of teaching English and real work so that ISKD situations would be reduced or avoided and learners' effective and meaningful learning in the desired specific field or purpose can be conducted better and more smoothly.

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