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>
<thead>
<tr>
<th>Program</th>
<th>Instruction</th>
<th>students number (N)</th>
<th>Mean of the posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>WP</td>
<td>WCI</td>
<td>35</td>
<td>81.8</td>
</tr>
<tr>
<td></td>
<td>F2F</td>
<td>42</td>
<td>81.4</td>
</tr>
<tr>
<td>NP</td>
<td>WCI</td>
<td>30</td>
<td>73.5</td>
</tr>
<tr>
<td></td>
<td>F2F</td>
<td>66</td>
<td>74.9</td>
</tr>
<tr>
<td>DP</td>
<td>WCI</td>
<td>64</td>
<td>76.0</td>
</tr>
<tr>
<td></td>
<td>F2F</td>
<td>180</td>
<td>73.2</td>
</tr>
</tbody>
</table>

**Table 2. Means of the posttest for the instructions with and without courseware integration**

(WCI: instruction with courseware integration; F2F: instruction without courseware)

**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 fullcollaboration 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


