Keeping the content current in technology courses

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Across Japan, universities have opened information technology (IT) and science departments in recent years to prepare students for IT and other science careers. These new departments often include English for Science and Technology (EST) programs to assist student efforts in learning EST. In such programs, instructors who are usually not IT specialists must teach vocabulary and content for rapidly developing fields; this is especially problematic since textbooks become quickly outdated and materials are scarce. This article introduces three activities to update student knowledge concerning IT related topics and provides some basic guidelines for selecting and adapting appropriate materials.

日本の全国で、大学は、学生にITと他の科学キャリアについて準備さ　せるために近年情報技術(IT)と科学の学部を開設しました。これらの新しい学部はしばしば科学と技術のための英語（EST）プログラムを含み、ESTの学習における学生の努力を助けます。そのようなプログラムでは、通常、IT専門家でないインストラクターは、教科書がすぐに時代遅れになってしまい、教材が不十分になるので、特に問題が多く、急速に発展している分野のためのボキャブラリーと内容に対処していかねばなりません。この記事は、学生の知識をアップデートするための3つのアクティビティーを紹介し、適切な材料を選択して、適合させるための、いくつかの基本的なガイドラインを提供します。

As the number of potential university students dwindles year by year, one strategy some universities have used to attract applicants has been to create new departments promising quality education programs in various technological fields. With the emergence of such programs comes the need to educate students in English about their specific fields, such as English for Science and Technology (EST). While these programs pose various teaching and learning challenges, they also offer exciting opportunities

for teachers as materials designers to exercise their creativity while updating their own IT knowledge.

This article begins with a brief overview of some of the challenges teachers and students face, and then shows how Content-based Instruction (CBI) supports EST. Next we introduce some general frameworks and specific activities for addressing pedagogical challenges. We conclude with some general considerations for effective materials selection and design.

Our context

In 2004, Ritsumeikan University opened the College of Information Science and Engineering (CISE). The program aims to increase students' English language proficiency and deepen their knowledge of Information Technology (IT) to prepare them for engineering and computer-related careers. The new department further allows Ritsumeikan University to compete with other similar Kansai-based programs, such as Doshisha University's Information Science Department and Kwansei Gakuin University's Information Technology Department. For science students, the program is demanding; in addition to their core major classes, all CISE students complete 2 years of English for Specific Purposes (ESP) courses.

The CISE English Language Program (ELP) serves students from five majors, and as such, must incorporate IT-specific content yet be accessible for students with different career goals. (Students major in Computer Science, Information and Communication Science, Media Technology, Human and Computer Intelligence, or Bioscience and Bioinformatics). First-year students take three English courses per semester and second-year students take two per semester. In these courses, students complete IT-textbook activities using Infotech (Esteras, 2002) along with essay-writing, discussions, presentations, and individual and collaborative project work.

Teaching and learning obstacles

Students and teachers alike face similar challenges in EST programs. One of the primary obstacles is teaching a specialized lexis. Another challenge is dealing with textbooks and other materials which quickly become outdated in rapidly developing fields. Last, for most teachers and students, the content may be unfamiliar.

For teachers, teaching IT content can be challenging since many teachers are not content specialists. Being equipped with only an IT textbook can be daunting, especially when the teacher is expected to be an *expert*. Moreover, as these textbooks become outdated and teachers do not update their knowledge, they often find themselves unable to cope with content-specific questions in class. This situation can be stressful and demotivating as teachers struggle to maintain their professionalism in the classroom. In the CISE, for example, the Infotech textbook fails to deliver the most current information to students.

Students also struggle in EST courses in a number of ways. While some students may possess some content knowledge in their field, many do not, and if they do, it is likely they are familiar with it only in Japanese. Not only do students often lack IT vocabulary, but they also often enter university with

limited English proficiency. This puts students with lower levels of English at a greater disadvantage as they must cope with new content, new vocabulary, and learn English all at the same time.

Content-based instruction

Content-based instruction (CBI) is "…the integration of particular content with language teaching aims…the concurrent teaching of academic subject matter and second language skills" (Brinton, Snow, & Wesche, 1989, p. 2). There are three different models which describe how the integration of content and language learning can occur. The Sheltered Model usually occurs in L1 contexts where team teachers give learners special assistance to help them understand regular classes (Davies, 2003). The Adjunct Model also occurs in L1 contexts, and the instruction is usually aimed at preparing students so that they will be able to participate and learn in regular university courses. The final model, which is commonplace in many EST programs in Japan, is the Theme Based Model. In this model, instruction is based on the content of the assigned textbook, a collection of authentic materials based on a specific theme or information from the Internet.

Solutions

The three example activities described below draw on current teaching and learning theories. Examples one and two are grounded in the principles of cooperative learning. In cooperative learning activities, students become *experts* for a specific chunk of content which they peer-teach to their classmates (Johnson & Johnson, 1994, p. 276). These two example activities also utilize graphic organizers, which are pictorial representations of organizing information to enhance understanding, comprehension, and synthesis of old and new information (Novak, 1998, p. 34). Examples of graphic organizers include matrices (also known as charts or tables), Venn diagrams, and concept maps, among others (Enchanted Learning Website, 2007). All three activities make use of authentic materials to motivate students and expose them to the most current information available.

Example activity 1: Adaptive technology research

Infotech's Unit 10, *I/O Devices for the Disabled*, looks at how input (i.e., keyboard or mouse) and output (i.e., printer or monitor) devices' technology can be adapted for computer users with visual, hearing, or mobility limitations. The unit includes a reading task, listening exercise, and writing activity; however, content for speaking activities is not included. To supplement the materials in the unit, students were required to research an input or output device on the Internet and present the information to their peers.

The students were assigned homework that required them to research one adaptive technology device or software. To help the students cope with the vast amounts of authentic material on the Internet, a handout was prepared which provided the URL for a specific website, <www.abilityhub.com>, dedicated to the sale of adaptive equipment and computer access solutions. In addition, four questions about the equipment or software were assigned to help the students gather information: who might use it; how does it work; how much does it cost; and what are the system requirements.

Last, they were required to bring a picture of the device.

In the next class, students explained, compared, and wrote about their adaptive equipment or software. Students were given five minutes to review their notes and to practice how they would explain their item to their partner. Then in pairs, students showed their pictures and discussed the questions noted above. After both partners finished their explanations, they used a Venn Diagram (a type of graphic organizer composed of two or three interlocking circles) and compared the users, the cost, and the system requirements. In the overlapping area of the two circles, students wrote about the similarities between their devices, and then the features that were specific to their device were written in the outer circles.

The final activity was to write about their item. As a way to bring closure to the speaking activity, students were asked to do a timed writing for ten minutes. This provided them with the opportunity to consolidate the key vocabulary, technology, and concepts associated with adaptive technology and computer users.

Example activity 2: Researching internet browsers

Infotech's Unit 18, *Internet Issues*, provides a very basic overview of the Internet. While it explains what a web browser is, it does not mention the various browser options computer users have. The following activity helps students understand about the various browsers available.

This activity began with in-class brainstorming. In groups, students first made a list of all the browsers they knew. The teacher then assigned one browser per group. Students identified what they already knew about the browser and what they would like to know about the browser in a T-chart graphic organizer. A T-chart is simply a *T*, separating knowledge into two broad areas (see Figure 1 below). This type of brainstorming task activated students' prior knowledge and focused them for internet research to come.

What I already know	What I want to know

Figure 1. T-chart

For homework, students located and printed one article about their assigned browser. While reading, students used previously learned reading strategies (i.e., highlighting important information and writing annotations in the margins), and after reading, they wrote notes on a handout (see Figure 2) about their article to prepare themselves for in-class peer teaching.

In the next class, students with the same browser confirmed their answers. Groups were then re-shuffled with students who researched each different browser in each group. Students then peer-taught each other about their browsers and took notes in a *matrix* graphic organizer or chart (see Figure 2). Note-taking in the chart encouraged students to write only the most important information as phrases and key words, rather than writing complete sentences.

	Browser:	Browser:	Browser:
When / who created it			
Development			
Features			
Strengths			
Weaknesses			
Future outlook			

Figure 2. Matrix

After note-taking, students completed two critical thinking activities to synthesize and evaluate new information. First, using a Venn diagram, they identified the similarities and differences among the three browsers. In this case, the Venn diagram is composed of three interlocking circles, one for each browser. Then students were asked to imagine that they were part of a committee that had been assigned to choose one browser to be used on the university campus. Using the information in their matrix and Venn diagram, students selected one browser and justified their choice. These final tasks helped students consolidate knowledge and further strengthened their group work skills.

Through this activity, students were exposed to authentic materials and also had opportunities to confirm their understanding in groups. As students share, compare, and categorize information, they come to understand the content more deeply. As peer-teachers, students become accountable for the content, and therefore bear some responsibility in the activity. Last, students practice a number of microskills: reading, note-taking, listening, and speaking.

Example activity 3: Invention extension

The challenges outlined earlier in respect to teaching and studying in EST programs highlights a dilemma for teachers. Should their role be to improve English proficiency where it is evidently lacking? On the other hand, would it be more beneficial to concentrate on the content of the program, so as to help students grasp areas of knowledge that will help them in their subsequent studies?

These issues pose some interesting pedagogical challenges. Keeping the challenges in mind should be the aim of any English teacher that teaches CBI and other specialized programs. Meeting these challenges and creating an interesting lesson that covers content and works on integrating core language skills, should satisfy the above mentioned issues.

The wealth of materials available in IT is both a hindrance and help. The Internet and other media forums are constantly updated with information. Also, it can be difficult to stay on top of the information. For some teachers, this is a chance to improve and update their knowledge, and at the same time, share this information in a meaningful and appropriate way with their students.

One particular media forum, newspapers, offers an avenue from which to gain knowledge. Appropriate texts can then be used constructively in class. Firstly, identifying a relevant topic is the first important stage in choosing a text. Does the article offer a chance for students to gain some relevant

knowledge? Can students process this subject matter through the skills used in the lesson? Taking an appropriate article, or rewriting a slightly more difficult one, will allow the teacher to introduce the material to the students in the class.

In the EST program, students are required to make a presentation demonstrating some kind of invention or device they have created. Whilst supporting and accessing their presentation and language skills is important, demonstrating an understanding of technology is also key. For example, a short article about a new invention can really help some students make a connection between abstract ideas and cutting-edge technology.

A short preview exercise and brainstorming activity based on the topic of a newspaper article will generate lots of ideas. Following this exercise, preparing and scaffolding the article will help the students to understand the topic. Making a short synonym-match activity enables vocabulary relevant to the context to be understood. After preview and vocabulary activities, a comprehension exercise helps to make the connection to the presentation clearer.

Depending upon the level of the class, this exercise can be structured in different ways. A lower level class might benefit from being given the comprehension questions before the listening exercise. For higher-level classes, a note-taking activity will allow the students to gather the relevant information and answer the questions.

This kind of integrative skills approach has some advantages. The activities are short and enable the teacher to keep the students interested. Activities have been structured by the teacher, and therefore, should be at the appropriate level for the class. Students have learnt about a new and interesting topic relevant to their presentation. This approach is beneficial to the teacher and students. Both parties can learn about new technology, and it is shared in a way that develops students' understanding and confidence.

A follow-up to this lesson could involve students identifying and selecting materials to study. In small groups, students take turns finding an article that has some relevance to IT/Technology news. It's important to make sure they understand the appropriateness of the material. Length and density of text, and also style, are important factors to consider when choosing an article. After modeling appropriate articles, students select articles and complete worksheets. The worksheets are used to indicate key and difficult vocabulary for the other group members. Identifying and selecting key points from the article will help students gain a better understanding of the text. Finally, the designated students will write some discussion questions related to the article.

This process leads smoothly into a class where the students use up-to-date materials to study key reading skills. Again, vocabulary relevant to the context is studied. Part of the emphasis is on independent learning strategies, where students contribute significantly to the materials used.

Materials design criteria

The process of materials design poses questions such as the availability of materials and the appropriateness, in terms of learners and their interests. Furthermore, how adaptable are the materials? And finally, are the materials authentic?

The availability of materials is probably the easiest of these considerations. There is a wealth of material (see Appendix 1 for example websites). However, this does require trying to follow the latest developments. Encouraging independent learning will allow students to participate more in the selection of materials. Furthermore, the teacher can collect the materials from the news, through newspapers, websites, and TV programs.

The structure of the EST program outlined at the outset of this article indicates the diversity of majors studied. The students major in Computer Science, Information and Communication Science, Media Technology, Human and Computer Intelligence, or Bioscience and Bioinformatics. The range of topics chosen to study can be of a more general nature than the majors that the students study.

Adapting the articles is certainly not without its challenges. If this process becomes too time consuming, and the lesson is too teacher oriented, then it's possible the materials were not adaptable. In short, the materials design process is cyclical and organic; the teacher needs to constantly balance students' needs and abilities and elicit feedback on materials (Hutchinson & Waters, 1987, p. 87).

The authenticity of the materials is one area where students can help. In the EST program, outdated materials were used to pose certain questions to the students. For example, students were asked, "If we were looking at this picture or diagram from a textbook printed this year, what would be different?" Questions such as this help students to demonstrate their knowledge of the subject matter. Also, this kind of approach gives the teacher the opportunity to find out about students' knowledge and interests.

Final thoughts

The teaching of EST poses a number of challenges for students and teachers, especially in terms of bringing the most current content to the classroom. However, there are a number of ways to update students' knowledge. Teachers can create cooperative learning activities that allow students to become experts on a certain topic and then share their knowledge with other students. In this way, the burden of locating and teaching new information is shared among students. Some teachers are also quite keen on the topic area, and if so, they may find themselves naturally collecting content-specific articles. Once these articles have been located, teachers can bring them in, as the topics seem suitable.

Teachers in EST settings need not panic about outdated content. The Internet offers a wealth of content that both teachers and students can exploit. In addition, students often know about a particular content area in Japanese, and if teachers allow L1 use in the classroom, explanations in Japanese can be an effective way to activate students' learning. Last, the use of learning tools such as graphic organizers can promote deeper understanding and synthesis of new information, especially to visual learners. In short, teaching EST can be a rewarding learning experience for teachers and learners alike.

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Appendix 1

Materials resources

Breaking News English Website <www.breakingnewsenglish.com/>

CNN.com Technology Website <edition.cnn.com/TECH/>

How Stuff Works Website <www.howstuffworks.com/>