

generally greater than the number of available computers. In addition, many of the computers in use are old enough to be considered obsolete by current standards (Reilly, 1996). Even if there are enough computers, students may sometimes experience difficulty logging onto the college's computer network. If many students attempt to log on at the same time, system overloads and slowdowns may result or the system may crash entirely. When this happens, lessons will go unfinished in spite of the most careful planning. This means that instructors using the Internet must always prepare back-up activities, perhaps in the form of printed worksheets or texts that students can complete offline.

In spite of these potential difficulties, the Internet is a useful and highly motivating resource that should, whenever possible, be incorporated into content-based college ESL courses. When students learn how to use the Internet, it becomes a vehicle for meaningful learning and can offer a multitude of educational benefits, both linguistic and cognitive.

DESIGNING EFFECTIVE COURSE ACTIVITIES

As stated in the previous sections, the Internet can be an effective tool for building both English language and critical literacy skills, as it promotes student-centered learning and enhances metacognition. For the Internet to be used most effectively in CBI, course activities must take advantage of the Internet's potential to develop ESL students' linguistic and academic skills by putting them in charge of their own learning. Activities that promote students' choice of and responsibility for course content result in active engagement in a learning experience that is perceived by students as relevant to their linguistic and academic goals. As reported by Brinton in chapter 3 of this volume, perceived relevance appears to be a critical factor in the effectiveness of CBI. Therefore, activities that engage students in study that is personally meaningful should be promoted in content-based courses.

I believe that to maximize the acquisition of language and academic skills, content-based activities should require students to read widely on subject areas that they have chosen to study in depth, should encourage collaborative learning, and should provide extensive practice in conducting and reporting on academic research. I developed an activity that I call *focus discipline research* to meet each of these goals. Focus discipline research provides ESL students with the opportunity to develop and refine reading, writing, and critical literacy skills as they build a strong knowledge base through sustained research in a discipline they have chosen to study over time. Focus discipline research provides the context for what Pally (1997) referred to as *sustained content study* (p. 293), which benefits ESL instruction by engaging students in extended practice with both linguistic structures and disciplinary content and enabling them to become "content experts" in a subject area of their own choosing.

Students should be encouraged to choose their focus discipline based on personal interest and/or college major. In my course, students may choose a focus discipline from among the 10 content areas covered in their textbook, *Interdisciplinary English* (Kasper, 1998b).¹ Because they have chosen to do extensive research in that discipline, they are invested in a learning experience that is personally meaningful, important, and relevant.

Students are engaged in extended study of their chosen subject area through a series of progressive focus discipline papers. They are required to use the Internet as an informational resource in preparing these papers. Students are taught research skills, are given questions to guide their research, and work in collaborative groups with other students who have chosen to focus their study on the same discipline. Students in each of these *focus discipline groups* work as a team to gather and discuss information for their projects. Through these groups, learning becomes not only an individual endeavor, but also a social one as students work together to construct knowledge. Moreover, because peers become resources for furthering knowledge and understanding of content area and linguistic information (Strommen & Lincoln, 1992), common group goals are created and students are encouraged to cooperate to achieve these goals (Bracey, 1994). Thus, students become responsible not only for promoting their own learning, but also for contributing to the knowledge of the group.

COURSE DESCRIPTION

My pedagogical approach is illustrated by describing activities that I use in my high intermediate content-based ESL courses.² The high-intermediate level at my college translates into an entry TOEFL score of approximately 400. The activities described are used in a content-based unit on environmental science. The sciences are a popular area of study for ESL students in American higher education (*Open Doors*, 1996/97), and issues in the field of environmental science are often in the news and may impact other disciplines. For these reasons, many students choose environmental science as a focus discipline, and all students are motivated to learn more about this content area.

Among the topics studied by the entire class as part of the environmental science unit is the greenhouse effect, its immediate and possible future impact on our weather, and the resulting effects on issues in disciplines such as business and nutrition. The greenhouse effect is a timely topic these days and one for which there is a great deal of information to be found on the Internet.

¹The 10 disciplines represented in the text, *Interdisciplinary English*, are: linguistics, environmental science, computer science, mathematics, business and marketing, psychology, sociology, physical anthropology, biology, and diet and nutrition.

²All page citations refer to readings contained in the book, *Interdisciplinary English* (Kasper, 1998b).

Prereading Activity

The lesson on the greenhouse effect begins with a prereading exercise that asks students to consider how the climate of the earth has changed over the past 10 years. They are asked if they have experienced or heard about unusual storms, floods, drought, famine, or heat waves. They are asked to explain how they think these events are related to global warming. These questions prime students for the reading by activating preexisting schemata, or background knowledge.

The greenhouse effect is a somewhat abstract topic and one that requires some understanding of complex chemical principles. The global warming link from the web page of the Environmental Protection Agency (<http://www.epa.gov/globalwarming/>) contains additional hyperlinks to visual resources that may be used as a prereading activity to concretize these abstract scientific concepts and thereby facilitate comprehension. I direct students to one of these hyperlinks (<http://www.epa.gov/globalwarming/reports/slides/cc&i/b-ghouse.html>), which illustrates the greenhouse effect through a diagram depicting the earth, the sun, and the ozone layer. While viewing this visual, students go step by step through an analysis of what happens when the sun's ultraviolet radiation mixes with man-made pollutants. This web page facilitates comprehension in two ways—it serves as a visual prereading exercise, and it provides students with an imagery link that they can later access to clarify the complex scientific concepts that will be presented in the textbook reading, "The Greenhouse Effect" (Kasper, 1998b, pp. 35–39).

Interaction With Text

This reading defines the greenhouse effect and explains the cause–effect relationship between greenhouse gases and global warming. The text details the environmental, chemical, and political implications of ozone depletion and global warming. Thus the textbook chapter provides a general description of the Greenhouse Effect and discusses the many areas of everyday life that are affected by environmental factors. The chapter also offers a general view of what may happen if the greenhouse problem is not solved in the near future. As students read the textbook chapter, they engage in vocabulary building and express their understanding of the text through written answers to open-ended comprehension questions. We then discuss the contents of the chapter in class to check comprehension and clarify any questions students may have.

Furthering Knowledge Through an Internet Search

Now students are asked to search the Internet to find additional information on the greenhouse effect. To direct their Internet search and to help make

them aware of the critical reading skills being used, students are given the set of questions provided in Appendix I.

The lesson described in this chapter asks students to access web sites that deal with the greenhouse effect and its potential impact on business, nutrition, and governmental issues, to name just a few. For example, an article published on the web page of the Washington Post (<http://www.washingtonpost.com/wp-srv/Wplate/1997-11/12/1691-11297-idx.html>) describes some of the potential consequences of global warming (Warrick, 1997); while an article on the web page of the *New Scientist* (<http://global.newscientist.com/970719/features.html>) dismisses the greenhouse effect as a hoax (*New Scientist*, 1997). As students read these essays, they are exposed to contrasting opinions on this issue. This provides a wonderful opportunity to teach students the discourses of comparison—contrast and argumentation in which they describe and evaluate differing viewpoints in an essay. To prepare students to write this essay, we list the arguments for treating the Greenhouse Effect as a genuine problem versus those for viewing it as simply a hoax, and we analyze the strengths and weaknesses of each argument. Because climate plays such a major role in everyday life, students become very involved in researching this topic, and almost all of them, even those typically shy and quiet, express an opinion. Thus, Internet research becomes a highly motivating vehicle to developing linguistic and academic skills, as students actively practice the four basic language skills—reading, writing, listening, and speaking—and the critical thinking and analytical skills necessary for college-level work.

Synthesis of Concepts Through Writing

The final Internet search activity of the overall course lesson directs students to narrow the focus of their search to the impact of global warming on the world's economy and food supplies. This search prepares them for the final writing activity, which requires them to do an interdisciplinary analysis. In the final writing activity, students must put together all of the information they have gathered through the textbook reading and the Internet research to write an essay on the following topic:

Considering all the information you have gained from this unit, what are the potential effects of global warming on world nutrition? How may what we eat be affected by our changing global climate? What other areas of our lives will be affected by nutritional changes caused by the greenhouse effect?

Again, the instructional paradigm described here makes use of both print and electronic media to develop and enhance linguistic and content knowledge bases. As students acquire information, they link new knowledge to what they already know, creating a network of associations within the newly formed

knowledge base that may then be used to facilitate performance on future linguistic and academic tasks.

Focus Discipline Research

While the entire class studies the greenhouse effect and uses the Internet for additional research as part of the environmental science unit, students in the environmental science focus discipline group continue to research other topics related to this subject area throughout the semester. These students complete a series of three progressive papers in which they report on the additional information they have gathered through their extended research. The information in these three papers is then put together into a research project that culls all of the information acquired. Students must cite both the print and the electronic sources they have used to prepare this research project.

Students who choose environmental science as a focus discipline are asked to use both print and electronic media as sources for information on the following topics: recent changes in global climate, recent changes in geographical patterns due to climate, and the effects of a weather phenomenon known as El Niño.

They are asked to write three papers, due at regular intervals over the course of the semester, in which they describe and discuss each of these topics. In the first paper, students describe recent changes in global climate, answering the following questions in the essay: Have the predictions of scientists been correct? Has there been a gradual increase in global temperature over the past several years? Has there been an increase in storms and in unstable weather patterns?

In the second paper, students describe recent changes in geographical patterns as a result of the changing global climate. They search for information on beach and land erosion resulting from severe storms. They are asked to address the following questions in their essay: How have storms, floods, and other weather phenomena reshaped the coastlines and the appearance of the earth?

In the third paper, students describe the weather phenomenon known as El Niño, addressing the following questions in their essay: What environmental changes result from this weather system? How often does El Niño occur? What causes El Niño? What are the effects of El Niño on global climate?

Finally, students are required to synthesize the information gathered for the three progressive focus discipline projects into a final research project. The final research project described here is a five- to seven-page paper that requires students to draw interdisciplinary connections between environmental science and another content area as follows:

In a final research project of five to seven pages, bring together all of the information you have gathered and discuss the effects of a changing climate on either

business or government. Choose to focus on *only one* of these areas in your project, and answer the following questions: What are the specific effects of climate changes on <your chosen area>? How serious are these effects? What can be done to deal with problems caused by climate in <your chosen area>? What predictions have been made for the future in <your chosen area> in light of a continually changing climate? Please be sure to include a bibliography in which you cite each of the sources you have used to prepare your research project.

STUDENT ACCOMPLISHMENTS

Overall, the results of the focus discipline activity have been quite positive, and students have produced some very thoughtful responses in their research projects. The following excerpt from a focus discipline project on environmental science (reprinted with permission) is indicative of student accomplishments in this course. This paper, written by a high intermediate level student, presents a powerful analysis of the effects of a changing climate on the behavior of the world's governments. This student researched both print sources (books and magazines) and Internet sources (electronic newspapers and articles) to prepare the paper that follows:

About 150 years ago, the earth's atmosphere had remained unchanged for several thousand years. Since the mid-1900's, people's actions have been changing the heat ability of the atmosphere. Scientists who study the earth's atmosphere and climate have been talking about the greenhouse effect and finally about "global warming" ...

Politicians, who for years have ignored the warnings of scientists and environmental protection movements, are becoming alarmed. They are announcing and making decisions on an international scale ... In 1988, in order to protect the stratospheric ozone layer, 120 countries agreed to limit their use of CFCs and signed the Montreal Convention. In 1989, several heads of state and heads of government of the industrialized nations signed the Hague Appeal to turn public opinion to threats to the environment. Government authorities realized that climatic change is one of the questions on which the planet's future depends. The United States and Sweden had already prohibited the use of CFCs in aerosol cans towards the end of the 1980s; Germany has announced that it will have reduced its use by 95% ...

The International community has a serious problem, which has direct relation to global climate change. This is the problem of ozone depletion. Ten years ago the nations of the world came together in Montreal to take wise steps toward protecting the Earth's stratospheric ozone layer. These efforts were expanded in the scientific discovery—a hole in the ozone layer above Antarctica, which was the size of the North American continent.

After that discovery was confirmed the world's political system began to sign any agreement much easier than before. Copenhagen Agreement was signed in 1990. Nations have agreed on the nature of the climate change threat, and we have taken the first initial steps to destroy that threat. All the nations of the world will need to work together to develop our steps after the year 2000. So we must achieve a new aim for the future.

The great poet William Butler Yeats wrote, "I have spread my dreams under your feet. Tread softly because you tread on my dreams." Unless we tread softly, our dreams for the future will be nothing but dreams. Let us make sure that our next steps are the right ones.

This is a strong indication of the type of work students can produce when they are engaged in cognitively demanding tasks that foster the development of language skills through the exploration and analysis of content-based academic material. The ESL writer expressed both pride and amazement in an e-mail message (reprinted with permission):

"My DEAR TEACHER:

As you noticed, I tried to put as much efforts on my project as I could. If you remember from our first lessons, this topic attracted me. To be honest, I was scared by your first lessons, when you were telling us about our future assignments. I could never imagine before that I, ESL student, would read, understand, and discuss by writing of global warming, greenhouse effect, and El Niño. I am very proud of myself that I could reach it" (19 June, 1998).

Both overall performance and the quality of the projects produced in this course were very impressive. The pass rates in this high intermediate course, ESL 91, were significantly higher than those in the overall ESL program at my college. From ESL 91, students may move on to either ENG 92 or ENG 93, depending on their performance on departmental reading and writing examinations. On the basis of their scores on these examinations, 73.3% of the students in this course were able to skip a level, and move from ESL 91 to ENG 93. This is significantly better (Chi-squared = 28.47; $p < .001$) than performance in the ESL program overall, where only 21.4% of students were able to skip a level and move from ESL 91 to ENG 93. In addition, the percentage of my students who needed to repeat the ESL 91 course was significantly lower (Chi-squared = 5.64; $p < .02$), at only 8.3%, as compared with 21.2% of students in the overall program.

STUDENT FEEDBACK

In addition to higher pass rates, the benefits of incorporating the Internet into content-based ESL instruction are supported by students' enthusiastic feedback. Students have said that they love using the computer and are fascinated

by the amount of information available on the Internet. At first the computer intimidates some of them, but with practice most of them acquire the skills they need to explore its vast potential as a research and language learning tool. Many of the less computer literate students view developing these skills as a challenge and excitedly report their successes to the class. I have found, and students' feedback verifies, that the Internet never fails to engage them in learning and that it helps to increase their understanding of even complex interdisciplinary concepts.

Students report that this type of instruction is not only very motivating, but also very useful. They say that Internet resources help them develop and refine their English language skills, enabling them to study and practice various points of grammar, vocabulary, and mechanics on their own. In addition, they appreciate the opportunity to learn how to do research and how to present that research in a written format. After completing the focus discipline projects in my ESL course, students feel more confident about their ability to prepare research reports for their mainstream courses.

Working with the focus discipline groups has had several wonderful benefits. The focus discipline groups have resulted in strong multicultural friendships. Students bond with each other because they are involved in a common task. They support each other in their search for information and work to be sure each person in the group understands the topic. The social discourse afforded by the group encourages students to elaborate and reflect on both their own ideas and those of their peers, helping to build a strong personal and group knowledge base. Students enjoy the opportunity to build and to share knowledge with group members, and even those students who are typically shy and quiet become more confident about presenting their knowledge to their classmates.

CONCLUSION

The focus discipline activities described in this chapter actively engage students in sustained content study, require that they work through complex texts and use English as a means of increasing knowledge, and encourage students to network with each other as they discuss the information they each have gathered. Through activities that guide their Internet research projects (see appendices), students learn how to be critical readers and thinkers and how to evaluate the validity and reliability of research sources. As my own research has shown, these skills, developed in content-based ESL courses, benefit students long after they leave the ESL program and lead them to perform better in subsequent college courses (Kasper, 1997b).

At times there have been computers that did not work, Internet pages that loaded slowly, and system crashes on the college computer network. Yet, since I incorporated the Internet into my content-based college ESL courses, students arrive early for class, go to the computer lab on their free periods, and