DEVELOPING A DISCOURSE COMMUNITY:

TEACHING BIOCHEMISTRY USING THE

WORLD WIDE WEB

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INTRODUCTION

The dilemma is how to get university students actively engaged in learning science. Within the positivistic paradigm the teacher delivers the knowledge in nicely organized lectures with the students sitting passively in rows, taking notes, and often memorizing the material for tests. The teacher may connect to the students' prior learning, but often just begins where the teacher expects that the students should be in their thinking. The problem, of course, is that the students must start with their current understandings. Therefore, if the material presented does not connect to the students' prior understandings, the students may just memorize to pass the examinations. The question is, "Do the students really learn?" when they are mostly passive in the traditional university classroom. Some students will learn any way they are taught, but how can we engage more students actively in learning science?

Recent research has suggested that getting students involved by co-participating in a discourse community (Tobin, 1997) with the students and teachers using the language of the discipline, may help get students to learn (Lemke, 1995). To understand why it is important for
students to engage in discourse in the discipline, it is necessary to understand how we come to know.

The instructor's working theoretical framework for how we come to know is constructivism. Constructivism is "a theory which asserts that knowledge is not primarily received, but actively built and that the function of cognition is adaptive and serves the organization of the experiential world" (Glasersfeld, as quoted in Leonard, p. 9, 1997). Ernst von Glasersfeld extended his ideas further on constructivism when he stated, "Knowledge refers to conceptual structures that epistemic agents, given the range of present experience within their tradition of thought and language, consider viable" (Glasersfeld, 1989, p. 124). By students using the discourse of the discipline and listening to their peers use the language of the discipline, each student had a testing ground for their ideas, of trying to make their ideas viable.

**ACTION RESEARCH STUDY**

In fall '98, the author conducted an action research study in her senior-level biochemistry undergraduate classroom. Action research has been done more by K-12 teachers (Spiegel, Collins & Lappert, 1995; McDonald & Gilmer, 1997), but is starting to be conducted by university faculty as well (Gardner & Ayres, 1998). This Web-enhanced class met three times a week for 50 minute class periods for one semester. The instructor's goals were the following:

Encourage the students to be active learners.

Connect to the students' prior learning.
Provide a learning environment in which the students gain an overall perspective of biochemistry.

Have the students teach and learn from each other in collaborative groups.

Have the students learn the power of using the Internet as a source of up-to-date information on biochemistry.

Have the students learn how to develop Web sites on topics that students selected to study in depth.

Encourage students to reflect on their personal goals for the course and on their learning using an electronic portfolio.

LEARNING THE TECHNOLOGY

Basically, there were two course Web sites, both password protected. One developed by the university called Web-MC, contained a course homepage, syllabus, class schedule, specific resources for the class, assignments, rubric for assessments, communication links and help resources for use of the Web. The second Web site, Connecting Communities of Learners (Tobin, in press), provided a site where each student posted answers to end-of-chapter questions and reflected on his/her goals and contributions to the group Web sites, within an electronic portfolio.

In the beginning of the course, some time was spent learning the technology, as most students did not know how to use the Web as a search engine and most had never developed a Web site. By the middle of the semester,
students developed an expertise in technology, often with the help of other students in their collaborative group. In a typical week, the instructor taught one or one and a half class periods, with collaborative groups presenting the rest of the time. The teacher in her lectures, often tied to what the students had presented earlier.

**COLLABORATIVE GROUP WORK**

Students working in collaborative groups developed specialized Web sites, using a chemically oriented biochemistry textbook (Matthews & van Holde, 1996). Ten collaborative groups (of two or four students each) made group presentations for three of their ten Web sites to the other students in the class.

For each presentation, students peer assessed each other's Web site presentations and self assessed their own presentations. This was accomplished using a form developed by the instructor and presented in Figure 1 on the following page. The instructor collated the results, including her own comments, in typed format and distributed them to each member of the presenting group within a week. Students felt that this feedback from others helped them improve in their presentations. It also made them aware of what makes a presentation better, as they assessed each other's presentations.

<table>
<thead>
<tr>
<th>Name of student</th>
<th>Presenters’ initials</th>
<th>Date of presentation</th>
<th>Write a sentence that best describes your presentation.</th>
<th>What was your role in the project?</th>
<th>How did the project help you integrate new information?</th>
<th>What resources did you use?</th>
<th>What is your favorite resource and why?</th>
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WORK

groups developed technically oriented in Holde, 1996). For students each ten Web sites to

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Figure 1. Group Evaluation Form Of Web Site Presentation

Name of student presenters:
Presenters’ Topic:
Date of presentation:

Write a sentence on your group’s response to each question, and using the following rating scale:

4 excellent
3 very good
2 good
1 weak
0 poor

What was your interest in the material presented?

How did the presenters encourage you (and others) to get involved in the presentation?

What new information did you learn that you could integrate into other material learned in the course?

What resource information (i.e., Web site links, other resources) was shared with the class?

What is your overall evaluation of this group’s presentation?

Additional comments

WHAT WORKED, WHAT DIDN’T

The class completed the same number of chapters as did a parallel section of biochemistry using an all-lecture
format. Both classes used the same textbook during the same semester. The teaching assistant for the course developed a table of 100 Web sites that the students created, with active hyperlinks that allowed students to link to all the Web sites that all collaborative groups developed (Armstrong, 1998).

What worked best in this course was that the students learned much more in-depth knowledge than if it had been a traditional all-lecture course, as evidenced in their group Web sites and their individual electronic portfolio entries. The students engaged in the discourse of biochemistry in their Web sites, portfolio writings and oral presentations. They selected topics that tied to their career goals and interests, as indicated in Table 1 on the following page.

What did not work well was student frustration during the first few weeks as students tried to learn to use the Web while they were simultaneously trying to learn biochemistry. The instructor did not think she could afford to spend more class time teaching students how to use the Web or the course Web site during class time, if the students were to learn the biochemistry. However, one extra laboratory session per week was scheduled that some students attended near the beginning to help with the technology. By the middle of the semester, students were more comfortable using the Web and developing Web sites.


Table 1

| Students for the course | Additional feed nature, on whole course, from the performance. Will be interested in enhanced course in the future. |

http://istal.com/
The instructor gave an anonymous questionnaire to all the students during the last week of classes to get additional feedback, of both a quantitative and qualitative nature, on what worked and what did not work in the course, from the students' perspective. The objective was to help in preparing for the next offering of the course. It will be interesting to see how the students from the Web-enhanced course compare with those from the all-lecture course in the second semester part of the course.

REFERENCES


