# Students and Teacher as Co-conspirators in Learning

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*In this paper the authors describe how technology can carry the burden of transforming the teacher's role from traditional to constructivist or, to use a metaphor, for students and teacher to become co-conspirators in learning. Over the past five years, seventh-grade students used multimedia as a component of a science unit about mammals. In their study of mammals, there were two distinct microworlds where the students constructed knowledge: the science lab and the technology lab. In the science lab the role of the teacher was one of content expert. In the technology lab the teacher and students shared expertise. Technology enabled the teacher to modify his primary role from content expert to co-learner. The authors describe the two microworlds and discuss the different roles the teacher assumed in each environment.*

Over the past five years, we have studied seventh graders' use of multimedia as a component of a science unit on mammals (Dipinto & Turner, 1995; Turner & Dipinto, 1991, 1992, 1993), In this technology-enriched learning environment, we have observed the transformation of the teacher's role. In particular, we have observed how technology can carry the burden of transforming the teacher's role from traditional to constructivist.. In effect, students and teacher become co-con-

spirators in learning. In a technology-enriched environment teachers experiment with various new and unfamiliar instructional strategies, and in the process, confront their beliefs about the teacher's and students' roles in the classroom (Ringstaff, et. al., 1991). The introduction of technology serves as both a symbol and a focal point for change that invites teachers to reexamine their traditional role as dispensers of knowledge and encourages them to adopt a constructivist role as co-learners with students.

The Hypermedia Zoo Project involves seventh graders and their science teacher in two distinct classroom activities. In the first activity, the students design and author a multimedia document based on their individual observations of a mammal at a large urban zoo; this occurs in the technology lab. In the second activity, the students conduct library research about their mammal and write a term paper; this occurs in the science lab and classroom. Thus, in their study of mammals there are two distinct microworlds where the students construct knowledge: the science lab and the technology lab. In the science lab the role of the teacher is one of content expert. In the technology lab the teacher and students share expertise. Technology enables the teacher to modify his primary role from content expert to co-learner. Furthermore, this shift in roles occurs even when the teacher is, as in this case, an experienced teacher of both science and technology and is knowledgeable and comfortable in both domains.

A matrix of teacher's roles emerges from this study: manager, learner, instructor, collaborator, explorer, assessor, conversationalist, audience, and model.. We will describe the two microworlds and discuss the different roles the teacher assumed in each environment..

## The Science Lab Microworld

The techniques for writing the mammal term paper are fairly traditional.. Students learn how to locate appropriate library materials; how to take notes from a variety of sources, i.e. books, journals, interviews, videos, etc.; how to prepare an outline; and

how to present ideas and support them with citations to references. The topics which students must cover in the term paper are specified in the science curriculum: physical description, classification, zoo habitat, natural habitat, critique of zoo habitat, range, human impact, and mammal behavior. In addition, students compose a variety of expository and creative writings related to mammals. The teacher's role in this process is also fairly traditional: the teacher is the *instructor,* the *manager* of the instructional process, the *audience* for the students' writing, and *assessor* of each student's achievement. .

Yet this is not a traditional classroom. It exemplifies most of the characteristics Brooks and Brooks (1993) and Loucks-Horsleyet. . al. (1990) describe as defining a constructivist classroom environment.. Although there is an initial focus on basic scientific and writing skills, the overall emphasis is on pursuing student questions with the goal for each individual learner to understand the interrelatedness of life grounded in the specificity of an individual mammal.. There is no *tabula rasa* mentality here. Information is not given; rather students discover questions to explore. The teacher is interactive, mediating the information sources with these student inquiries. Assessment is not a teacher-constructed evaluation at the conclusion of the unit but an integral part of learning, woven throughout the project.. In spite of this student-centered approach, students still perceive the role of the teacher as the "sage on a stage." In the words of two students, who were asked by the teacher to compare the science lab environment to the technology lab environment: .

> Jacob: Well, it [the science lab] is *your* classroom. We get to do lots of neat stuff and you give us lots of freedom but you still are the teacher!
> Jessie: In science you'll say "OK, this is what we are talking about
> and ... "

From the students' point of view, the teacher is the one in charge

in the science lab micro world.

Technology Lab Microworld

In the technology lab microworld the students learn to use HyperCard to create multimedia research reports about mammals. Each student observes, records and illustrates the physical characteristics, locomotion, and behavior of a specific mammal during four field trips to a zoo. Then they determine what information to include in their report, organize it into screen-size cards, link the cards together in a meaningful way, and present their reports as multimedia documents incorporating text, scanned graphics, videodisc images, recorded sound, and QuickTime movies.

Several elements of the technology-enriched environment contribute to the transformation of the teacher's role. First, exploration is the primary mode of instruction. In the science lab, students are concerned about doing the investigation or research paper the "right" way. This attitude focuses the expertise on the teacher.. In the technology lab, the teacher encourages the students to explore a variety of HyperCard stacks and modify some of them by adding their own stories, graphics, and links. This exploratory process establishes shared expertise among the students. Expert knowledge about the technology resides in the students as much as in the teacher.

Second, in the technology lab collaboration is natural and spontaneous. Students actively seek help from their classmates and provide help when asked. In their individual explorations students learn different things about the technology and are enthusiastic about sharing their discoveries with each other.

Third, the technology environment provides opportunities for student-centered assessment activities. For a peer assessment activity, for example, the teacher guided students as they brainstormed ideas and developed a form to guide them in reviewing one another's stacks. As part of their self-assessment, students wrote a reflective essay about what they learned while doing their HyperCard project..

Fourth, as Brown and Campione (1990) also observed, the technology environment facilitates the development of a community of learners among students and teacher. In the science lab microworld the students view the teacher as an outsider to their learning and social culture, but in the technology lab microworld the role of the teacher is de-emphasized to the point where students are empowered to take charge of their individual learning.

> Jessie: I like how a teacher can become a student and the students can be teachers [in the Mac lab].

This sense of community is made possible when the students invite the teacher to be part of their learning culture and its inherent social interactions.

> Nick: The teaching involved us relying on each other-a very good thing-with minimal boundaries. The major good thing about the teaching method used is that it brought us together more as a class. This was simply because we had to rely on each other for help as well as be responsible enough to help other people. It is a lot easier to come together as a community when you all have a common assignment, with the same problems and things to do. You can relate to someone very well. There are conversations about how the QuickTime movie won't work on your stack for some reason or how you have had disk problems with saving stacks.

Even though the teacher participating in this project was committed to a student-centered constructivist pedagogy, establishing a sense of community was easier to accomplish in the technology lab than in the science lab.

Shared Roles

In the course of working in the technology lab, the roles of manager, leamer, instructor, collaborator, explorer, assessor, conversationalist, audience, and model are shared among the students and teacher without any sense of transition mediated through the teacher.

Manager

The managing role requires that students maintain the physical environment and monitor their own and others' behavior so that the tasks can be accomplished efficiently. Students also recognize the need to share limited resources, such as one graphics scanner and one VCR.. In one instance Jessie assumed the role of manager for the computer station with a microphone:

> Jessie: Matt, are you done using the sound? If you're done, then you can switch computers because there are other people waiting to do sound.

Students even develop a sense of responsibility for specific hardware as a result of being trained as student experts.

Leamer and Instructor

The students already know that their primary role is learner. They also began to view the teacher as learner because he frequently modelled help-seeking behavior. When he couldn't solve a problem, he asked for ideas or assistance from the students. For example, the teacher was working with Eric to debug a scripting problem. After several minutes, he and Eric ran out of ideas and the teacher asked for help:

> Teacher to the class: Somebody come here. Eric is having a problem and we need someone who can navigate a bit with scripting.

Matt responded and the teacher left. After about ten minutes Matt and Eric successfully solved the problem.

The teacher also sought the students' expertise about technology to add to his own repertoire of HyperCard skills. For example, the teacher observed Jacob do a manual reset and asked what he did:

> Teacher: What did you hold down to do a manual reset? OpenApple-Option-Escape?
> Jacob: No, that's to do an exit. OpenApple-Control-Restart works on any Mac LC.

The students provided evidence in their written self-reflections that they recognized the teacher's role as co-learner:

> Jacob: We could show the teacher something and get off track so easily and still learn a lot.
> Matt: I like to be the teacher and give advice. It's neat how the teacher calls a student over to give another student advice.

Conversely, the teacher is primarily viewed by himself and the students as the instructor. However, for the students to share in this role, the teacher established student experts. Individual students were trained on specific techniques: scanning, accessing the videodisc, recording audio, and digitizing video. These students in turn were responsible for teaching their classmates how to do these things and for troubleshooting any problems.

> Katy: I became the expert on the scanner. I helped most people do their first scan. I thought that it would be a great responsibility to help all those people scan. I also felt good about being someone who helps in place of a teacher. I was very comfortable when another student helped me, unlike

> when a teacher helps and it is sort of tense. The kids know each other fairly well, and therefore, are able to help out more effectively.

Explorer, Collaborator, and Model

Exploration is essential in establishing multiple kinds of expertise among the members of the class. Some students explored the graphics options, another discovered visual effects, and another learned how to do animation. One student remarked that he "learned a lot of neat things" while another commented that she "discovered things worthy of questions." A third student reflected on the value of exploration:

> JJ: The teaching really let us explore by ourselves and solve our own problems. If you don't solve your own problems how can you learn?

Exploration led to collaboration. In exploring, the students learned different things about the technology and then they collaborated to share what they had learned. Collaboration led to finding the answers to questions among themselves.

> Matt:. Instead of a teacher doing everything, we each had a job. JJ did one thing, Marcus did another and I did something else. We mixed it all up and put it all together into a final product..

As a result, the teacher was free to explore in the technology microworld along with the students. The teacher collaborates by engaging in help-seeking behaviors as well as by facilitating peer collaboration. This role as collaborator also involves modeling how to help one another answer questions and solve problems. The teacher explicitly encouraged students to consult with classmates, to discuss design elements, and to move around the lab to observe and interact with classmates.

> Becky: When we talked to the teacher, he didn't just give us a solution; he helped us and talked us through it to see what we had done and see how we could fix it.

Conversationalist

The social nature of the technology lab micro world was an essential part of the students' experiences. The teacher became part of these social interactions as well. This sense of community was seen in the teacher and students' sensitivity to one another's feelings, their forgiving of mistakes, their sense of responsibility to help one another, and their joint sense of self-esteem. The teacher as conversationalist contributed to his inclusion in this community.

> Courtney: I liked how Mr D just dropped in and came by and joined the fun.

Although these dialogs arise out of the content of this project, the conversations sometimes occurred over lunch or even outside of school.

> Katy: Mr D came by and started talking about something that had nothing to do with laserdiscs; it was neat.
> James: We [the teacher and student] would just stop doing work and talk for a minute.
> Becky: In the Mac lab environment you can get away from your work and drop by and see what other friends are doing.

Audience and Assessor

By definition, the teacher is the primary audience and assessor of the students' work. However, one's peers are also a powerfully motivating audience. In the process of helping each other and sharing new discoveries, students tried out each others'

stacks and offered ideas and suggestions for improvements. In addition, students were required to ask a classmate to look at their stack and provide feedback before submitting their stack to the teacher..

These shared roles become the tapestry upon which the transformation of the teacher's role is viewed. The technology microworld is an example of a dynamic constructivist learning environment.. It has become a place where students and teacher become true co-conspirators in learning! In the words of one student:.

> Bridget:. I strongly think the way HyperCard was taught should not be changed. In fact, I think if it is changed the upcoming seventh grade class would be cheated out of an awesome kids' workshop run by kids. I think the way this seventh grade was taught, by the kids instructing others, is the best way to learn.

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