Got Tech?

Integrating Technology in the Secondary Classroom

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Rationale

> "In today's world, it isn't *what* you know, but rather what you *can* know – and how fast you can know something new. Technology is a non-negotiable tool in the process and a competitive advantage in terms of the speed at which we access that which is new." (Marshall, 2002)

We seem to hear it everywhere, "Technology is the key to the future." We must prepare our students and ourselves for the challenges we face in the coming decades; mathematics, science, and technology will play a key role in that future. In an increasingly global world, the person who knows how to access, organize and utilize information will have an advantage over those who do not. We are truly living in the information age. Even Time magazine's person of the year was "You", referring to the portion of society creating and developing our online virtual world. Where will my students fit in this world?

This question is where I began my study. Everyone from Bill Gates and Warren Buffet to Oprah seems to be discussing the failure of schools to prepare students for the future workplace. Is technology the answer? Some studies suggest that it does not promote student achievement (Toppo, 2006). However, other studies show evidence that technology can and does, support learning (Marshall, 2002). Even at my small school in Manhattan, a call to computers seems to have been heard. My school spent many weeks and much money going wireless and ordering new rolling labs of computers and A-V carts with LCD projectors.

However, while my school had the hardware and the software, few teachers were utilizing the many resources on a regular basis, with the exception of students using computers to type their work. At this point, I received professional development on how to create a class website using www.nylearns.org, and I took an online course about integrating technology into the classroom. After the coursework, I was motivated to put what I learned to good use. I did not want to be one of those teachers who learned something one day and never took it back into the classroom. I was going to *extreme makeover* my course, Introduction to Chemistry. In my little dream world, the students would be awed by the technology, inspired to surf the web and learn more, do more, be more!

Context

On television, makeover shows always start with the "before" shot so, in the best "makeover" tradition, here's a snapshot of my school and classroom. For the last seven years, I have worked at Manhattan Village Academy, a small alternative public high school. Manhattan Village Academy has approximately 370 students from diverse backgrounds (mostly Latino and African-American), and the majority of the students come from low-income homes. My school groups students heterogeneously and is an inclusion school. The school's block schedule system enables teachers on the same team grade to meet weekly and discuss student work and group progress. I teach an introductory chemistry course to all eleventh grade students, and the Chemistry Regents Exam is considered optional for my students. So, those students who do not do the Regents instead complete a Personal Science Project as part of the course requirements. Students have four 1-hour classes of chemistry a week, including lab, so time is a major concern whenever curricular changes are being considered.

The school has approximately 12 working computers in the library and 20 in the computer lab. These rooms have to be signed out by teachers in advance. In addition, the school purchased three rolling labs each containing 24 laptop computers. However, these rolling lab computers are not set up to print, the

batteries frequently die out, and the wireless network does not work in every classroom. There is no on-site technical support person, and outside technical support is rare. While there are a few computers in certain classrooms, these computers are generally older computers that are seldom used. It seems as if they are there for appearances sake. I took six of these computers from classrooms and placed one at each lab table in my classroom; I linked them together to the Internet to bypass any wireless problems; however, I could not arrange to have any of these computers print.

Planning the Makeover

Integrating technology into a course is not an obvious or easy process. There are so many questions to be answered before any real work can begin. What kind of access do my students have to computers? What types of technology should be introduced? How will technology affect student achievement and motivation? How will technology change my teaching?

I began with my students and their ability to access computers outside of my classroom. The Pew Internet &American Life Project showed that 87% of students have computers in the home. Early in the year, I let my students know that computer access would be a necessary part of the course, and that they needed to create a plan to gain computer access. I created a survey for my students, giving them possible choices for their computer access plan. I stressed that they would have time to find computer access if they did not have a computer in their home, and that I could help them to create a plan. This step of planning to use computers is important (Huett, 2004). My classroom surveys revealed that:

- 80% of my students had computers in the home
- 80% had internet access
- 98% of students had access to computers after school

(96 students total)

The 18% of students who did not have access at home had access to computers after school in the school's library or at a family member's home or a friend's home.

With the knowledge that my students would be able to use access computers outside my classroom, I proceeded to plan what types of technology to incorporate into the course. My choices included blogging, podcasting, e-mail, digital film, classroom websites, PowerPoint lectures, web-based inquiry, e-pals, online treasure hunts, chemistry tutorial software, online mentoring, discussion boards, social networking sites, and so much more. With so many choices, it was difficult to choose. In the end, I decided to focus on specific skills or objectives and utilize simple and familiar technology—ones with which my students were already familiar but had not had experience with on-line.

1) Responsibility and Note-taking/Test-taking – PowerPoint Lectures and Online Review Games
2) Technical writing/lab reports and Collaboration – E-mail Pair Share strategy
3) Research and Collaboration – Discussion Board
4) Responsibility and Accountability – Online Grade book

The Makeover Begins…

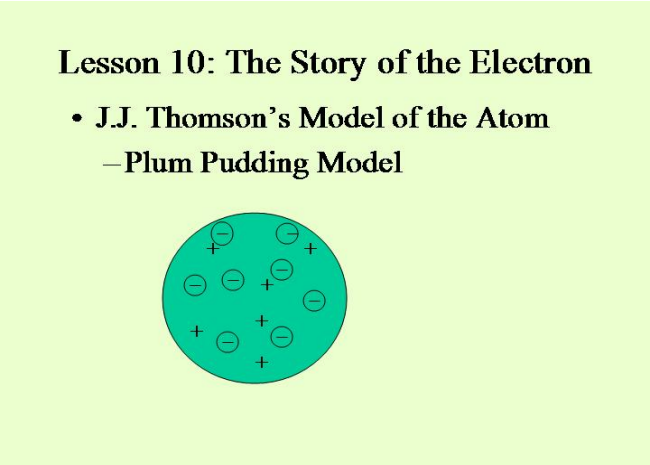
PowerPoint Lectures and Online Review Games

First, my students typically struggle with note-taking and test-taking in my course. Students have difficulty with the sheer volume of new information that is the NYS chemistry curriculum. In the past, I had noticed that students had difficulty when they were absent from class because they had missed so much information and the course is cumulative. Also, some students are not able to keep up with taking notes or take poor notes. Overall, I wanted a way for students to have access to lectures outside of the classroom for review. My plan was to use the PowerPoint slides in class and upload them to the class

website. In this way, I hoped to allow students to have access to the course notes at their convenience and to foster a sense of student responsibility.

PowerPoint lectures also seemed an easy starting point since I was familiar with the software and a LCD projector with laptop was available. Also, a number of college courses now use PowerPoint lectures and I wanted to make my students comfortable with such a format. The plan was to build student's note-taking skills slowly, beginning with brief slideshow lectures in September and gradually building the number of slides and the amount of content per lecture. An example of an early slideshow lecture appears below (see Figure 1):

Figure 1



E-mail-Pair-Share Strategy

There are many resources that can guide teachers regarding the use of e-mail in education. One particularly interesting study focused on the use of e-mail as part of a college chemistry course: Pence (1999) used e-mail as a way of having students work collaboratively outside of the classroom to work on a particular skill—problem-solving. Students also used e-mail to ask clarifying questions of the instructor. This study became the foundation for my E-mail Pair Share Strategy. I planned to use e-mail to facilitate collaboration outside of the classroom and to have students improve their technical writing skills, specifically their lab reports. Students would work in pairs. Partner A would write a first draft which would be e-mailed to Partner B. Partner B would copy and paste it, then edit and add to it. At this point, Partner B would e-mail the draft back to partner A and to me. A key component was that I needed to see each person's work; also, students were required to switch their position as A or B from report to report.

Feedback plays a vital role in learning, and e-mail can be an excellent delivery system In fact there is evidence that e-mail can promote cognitive growth, motivate learners, and create new learning opportunities (Huett, 2004). Other benefits are more immediate feedback, Internet experience, and increased interaction with other students. However, for e-mail feedback to be effective it must be reliable

First Semester	Second Semester
Quiz Average: 77%	Quiz Average: 74%
Exams: 73%	Exams: 72%
First Semester	Second Semester
Quiz Average: 77%	Quiz Average: 74%
Exams: 73%	Exams: 72%

and as immediate as possible (see Table 1).

Table 1

To this end, I planned e-mail assignments to be due in a specific timely manner. Short lab introductions were due on Thursday evenings (not every week). These short paragraphs were easy to read, and I would highlight errors and make suggestions for corrections or additions. I would immediately e-mail this back to both partners. In this way, I was able to edit all work in one evening (and it was easier and less time consuming than it sounds) and offer immediate feedback. On Friday, students would collect the data and compile their results. They had the weekend to write their lab conclusion using the Partner A/B system and e-mail it to me by Sunday evening with students sending it early receiving extra points for good planning. Planning for them and me was an important component to making the e-mail strategy work well.

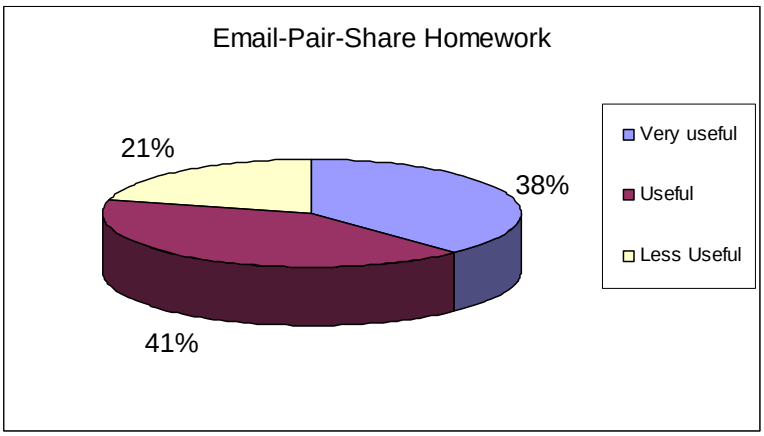
There were several advantages to this method. Students typed and edited their work over a period of days. Editing became a process between students, as well as a process between teacher and student. Also, as students worked with different people they read different writing styles and learned more about their own style of writing. Another bonus of this method was gaining class time. Previously, an entire class period was used for students to types and turn in their lab report. With the introduction of this method, students already had work typed and ready and all they had to do was copy and paste their work into the lab report template and do final edits; therefore, only ½ a class period was necessary.

Overall, student perceptions of this method were very positive. Even more positive was the effect of this strategy on their writing skills.

First Semester	Second Semester
Average Grade No e-mail: 78%	Average Grade W/o e-mail: 77% W/ e-mail: 90%

Clearly, those students who used the e-mail pair share strategy benefited from the process. Also, as the data came in I shared the results with my students, letting them know that students using the e-mail pair share strategy were scoring at least ten points higher than students who did not use the strategy. Over the course of second semester, more students joined the e-mail bandwagon. By the end of the semester, close to 80% of students found the e-mail strategy useful and were using it to improve their writing (see Figure 2).

Figure 2

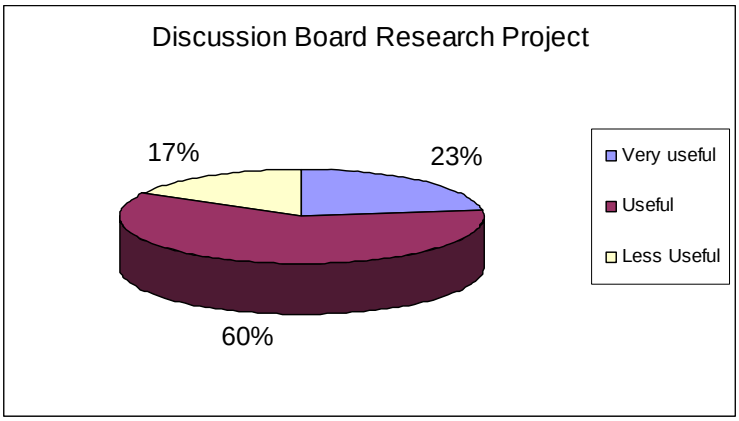


Discussion Board

I learned about discussion boards during my course on integrating technology in the classroom where it was heavily used. As well as enabling conversation among students outside of class, discussion boards can bring together people from different geographic regions. Since a goal of the chemistry course is to have students relate science to real world applications and everyday life and since students tend to see science as something that can only take place in a classroom or laboratory not as study that can take place everywhere from Pepsi and Nike factories to ecologists studying ice core samples or water testing, from hospitals to gas companies, the discussion board seemed a perfect solution for my quest to have scientists interact with my students. In addition, I was looking for a way to have students help each other with the research component of their Personal Science Project. I wanted students to not only help one another, but also learn about each other's topics. Therefore, I created a discussion board where students would post their topic and at least five research questions. Students were then assigned to help someone else with their research and respond by posting the answer and resource information on the discussion board. Students could earn extra credit by helping others (beyond their assigned person) with research. I also managed to bring a few scientists including a Pepsi chemist, a doctor, a geologist and a scuba master to engagement with the students on the discussion board.

The relative success of the method required careful planning. I created logins for the students and scientists, and I checked the board regularly for progress or problems. The introduction of outside guests seemed to add a sense of professionalism to the assignments that students commented on. Overall, student completion for this project was very high, particularly considering that the discussion board project was done completely outside of school over a holiday break. The completion rate of the project was 88%, and the average grade was 82%. Student evaluations revealed that 83% percent of the students found the discussion board helpful. (See Figure 3)

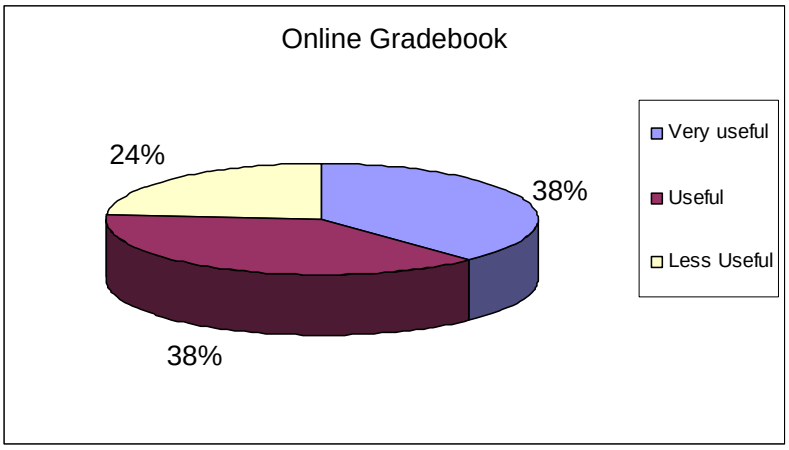
Figure 3



Online Grade Book

The main purpose of the online grade book was to encourage student responsibility and accountability. Students frequently lose track of missed assignments, and they also have difficulty keeping track of their progress or their grades. An online grade book helps with these problems. Instead of students using class time to figure out what assignments are missing or how they are progressing, they can go online and check for themselves. Throughout the year, I would see students checking their progress online at the beginning of class using the lab table computers. In fact, fall surveys showed that the online grade book

was the most visited part of the classroom website. End of the year surveys, revealed a drop in enthusiasm for the grade book, but discussions with students revealed this drop was due to the decrease in my ability to regularly update the online grade book.



My Makeover

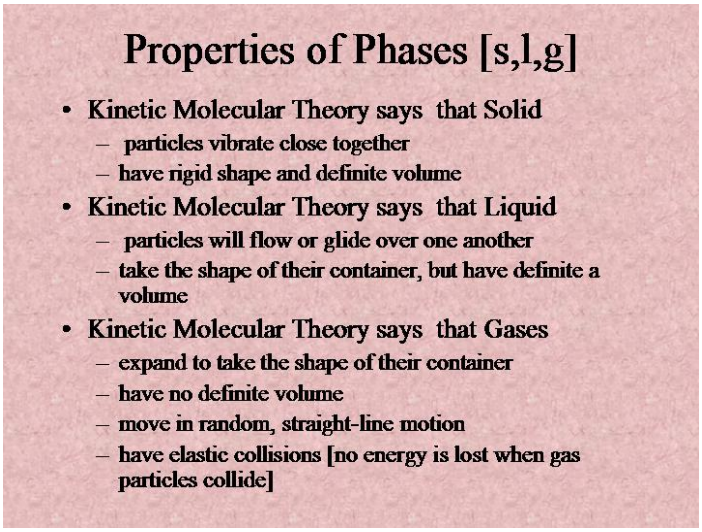
When I began the process, everything seemed easy and straightforward. I never imagined how much my teaching would change as a result of incorporating technology into the classroom. One major shift was that the technology, especially the PowerPoint lectures, seemed to take on a life of its own. Previously, my classroom had always focused on hands-on learning experiences and demonstrations, but as the PowerPoint lectures took hold, this aspect of the class would sometimes get lost. This was a surprising and disappointing reality that I will have to be very mindful of in the future. A second shift was how I spent my preparation time. While my makeover was not so extreme, at times the amount of time and effort seemed extreme. In hindsight, I should have gone more slowly; for example, not every lesson had to be put into PowerPoint format.

Over the course of the year, there were pros and cons to integrating technology into the classroom. First, my bad news: technology involves a lot of planning and it can be very time consuming. I spent between two to eight hours a week on m technology plans. Second, technology implementation without on-site technical support can be frustrating. I could spend hours creating a lesson, only to find the server is down or the computers in the lab overheated and are out of order. Last, technology planning should be part of a grade/department/school plan; individual teachers need to work together. This would help alleviate both time and support frustration and challenges. Now for my good news: technology did help facilitate student achievement, collaboration, and responsibility in my classroom. While not every piece of technology was equally beneficial, overall the changes to the course were well received by my students. My students commented that they felt the PowerPoint lectures were helpful to them now and believed that it helped prepare them for college. Several students were really excited about the discussion board with our science guests and were more interested in science class as a result of the experience. With the e-mail strategy in place, the majority of students (95%) stated that they felt their writing had improved throughout the course of the year. Lastly, I felt a great sense of accomplishment having created a website (the hub for lectures, discussion board, online games, grade book, etc) where my course was accessible to students, parents, and colleagues.

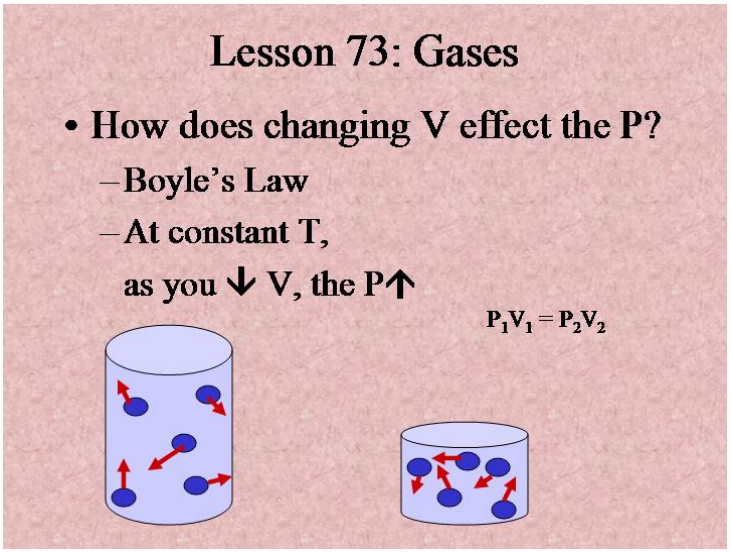
Before offering conclusions and policy recommendations, I want to share some specifics of the makeover, specifically what I learned, because I think they may be useful to others trying to move more toward implementing instructional technology. I begin with my experience with PowerPoint and move through the other strategies.

PowerPoint
As weeks went by, I observed that student note-taking was not improving. Students either frantically copied every slide and my talk word for word, or they just copied the slide with little interest in understanding its meaning. By mid-October, I transitioned from the PowerPoint lecture system to a purely verbal lecture system to work on student listening and focusing skills, as well as their note taking.

By February, I decided to attempt a new version of PowerPoint lectures: Preview-Review-Apply. First, I created more detailed PowerPoint lectures. Second, students were not allowed to take notes as I previewed the slideshow using the LCD projector. This Preview lecture was a time to explain the new concepts and take questions from the students. Next was the Review stage, students in small groups of four or five went through the slides again with their lab table computer, and this time they took notes. Lastly, students in their small groups worked together to complete online review games to apply the knowledge from the day's lecture. This Preview-Review-Apply strategy had mixed results. Some students were able to take advantage of the small group collaboration to take better notes and understand the notes as they worked through the games. However, as the weeks went by student interest waned, attention during the Preview lecture was low, and thoughtful completion of the application games decreased.



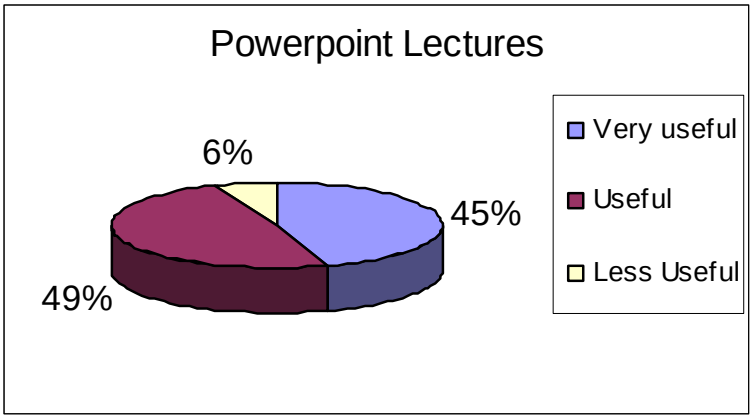
For examples of the online review games, visit the class website at www.nylearns/tredican.
Some of the class favorites were the Walk the Plank and Fling the Teacher games.
In March, I decided to make a final attempt at revising the PowerPoint lectures system. I made "barebones" PowerPoint lectures. These slideshows had far less information on the screen. The process became a mixture of visuals and verbal lectures. This strategy was somewhat more successful in keeping the class on task; however, note-taking skills still remained poor, as students again attempted to take notes in complete sentences with neat pictures, rather than writing down key information and sketching helpful visuals. Also, this strategy had come far from my original intention, which was to have the PowerPoint lectures serve students in the classroom and outside of the classroom.



I assessed the effectiveness of the PowerPoint lectures through classroom observations and student surveys. Also, I used quiz and test grades, since students may use their lecture notes on all quizzes and tests.

By the end of the year, it was clear that students preferred the PowerPoint lectures to traditional oral lectures (see Figure 4) and some students did access the lectures online either to make up missed work or to review material that was an original goal of the lectures. However, despite these favorable student reviews, student achievement on quizzes and tests did not change. Similar results were found by researchers at McGill University (Harpp, 2004) where online chemistry lectures were offered in coordination with traditional classes: While 97% of the college students used the online lectures and 91% found them useful, "grades do not seem to be affected in any dramatic fashion by the retrieval lecture system."

Figure 4



The mixed results of the PowerPoint lecture system are puzzling. Unlike the students in the McGill study (Harpp, 2004), my students did not regularly use this feature. My students seemed to prefer the PowerPoint system because: "It was easier to understand, we could write it down, then you would explain it." "You could see and hear it." "Because if you have especially low attention skills, you have a computer to look – just talking is boring and you can lose focus."

I hope and believe the difficulties of this year's PowerPoint instruction were due to a lack of forethought and clarity on my part. I do not plan to abandon PowerPoint lectures; however, I do believe that I need to clarify my own goals and uses of this method of instruction. The PowerPoint lectures for online access need to fulfill different requirements and needs than an in-class presentation. Online lectures need include detailed written notes with online interactive games and labs. While in-class lectures need to be brief, more visually interesting with few written details. In the classroom, students can complete hands-on interactive instruction. Since the completion of the school year, I have been able to look into PowerPoint design for classroom use, and I have begun to make some changes. One particularly helpful site was *Extreme PowerPoint Makeover*.

E-Mail Pair Share Strategy

I plan to continue using the E-mail Pair Share Strategy next year. In one way, it was a way to conference with students about their writing without using large amounts of class time. I would like to find other ways to utilize the email collaboration strategy possibly to encourage more student ownership and less teacher-directed work. Also, I am concerned that e-mail will lose significance among teens as IM and social networking sites continue to gain in popularity. I would like to find a way to incorporate these similar technologies into the course.

Discussion Board

Next year, I would like to modify the use of the discussion board. On some levels, I think the board served its purpose as a place to help each other post research; on other levels, it could be organized to make connections between scientists and students stronger and more relative. Perhaps, an extension of the board could be videoconferencing or IM sessions where I act as the moderator. In addition, a greater number of guest scientists would have created even more "buzz" about going online; particularly, if I could align student interests with professionals in the field. This will require more advanced planning and use of "ask expert" sites and possibly online mentoring sites.

Policy Recommendations

Technology planning should take place on many levels: individual classroom, grade, department, and school-wide. Schools need to invest not only in the hard ware and software of technology, but in the planning, incorporation, and support of the new technology in the classrooms. Teachers need practical professional development for utilizing technology, such as: developing classroom websites, creating PowerPoint lectures, and using e-mail to facilitate student achievement. On-site technical support needs to be available on a regular basis. Technology coaches cannot replace technical support. Schools need to provide user-friendly online grade books and discussion boards for teachers to use with their students. Schools also need to provide time for teachers to develop their technology plan.

Useful Resources

Alick, D. (1999). Integrating Multimedia and Multiple Intelligences to Ensure Quality Learning in a High School Biology Classroom. EDUC 685-Multimedia Literacy. <http://www.angelfire.com/de2/dalick/researchMI.htm>

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"Face to Face Workshops." Professional Development.<http://www.iearn.org/professinal/workshop.html>

"Improving the Use of Discussion Boards". Teaching with Technology Collaboratory. 30 August 2005. <http://www.wpi.edu/Academics/ATC/Collaboratory/Idea/boards.html>