Teaching Weather Online: Five Steps to Success

Presented at the 13th Symposium on Education
2004 AMS Annual Meeting

James A. Brey, Ph.D.
Professor of Geography and Geology
University of Wisconsin - Fox Valley
Menasha, Wisconsin, U.S.A.
jbrey@uwc.edu

Introduction

Success at offering an atmospheric science course with a lab totally online is now easier than ever. This presentation will discuss 5 steps that can be taken during an online offering which will enhance student learning, minimize attrition and improve student satisfaction. Using examples from four years of experience, I will demonstrate specific strategies used to encourage early communication, build motivation, facilitate understanding, increase learning and bolster retention of what is learned.

AMS Online Weather Studies

The American Meteorological Society (AMS) Online Weather Studies course *http://www.ametsoc.org/amsedu/online/info/index.html* materials were used in the courses that were the basis for this study. Online Weather Studies is an introductory college-level, online distance-learning course in the fundamentals of atmospheric science, where students study weather as it happens. The course was developed by a team of meteorologists and educators as an adaptation of the National Science Foundation funded AMS DataStreme (Atmosphere) course which has been offered since 1996 *http://www.ametsoc.org/dstreme/index.html* . Online Weather Studies was developed, pilot-tested and nationally implemented as an introductory college-level, online distance-learning course in the fundamentals of atmospheric science in 1999. The course addresses the need for innovative and cost-effective lab science education opportunities for an increasingly diverse and non-traditional student population. Students study weather as it happens. It has been offered at over 180 two- and four-year institutions of higher learning in the United States over the past five years, primarily at institutions that do not have an atmospheric science program. The course is offered in natural science, earth science and geography departments. I have used the DataStreme course, a hybrid course for teacher enhancement, and the Online Weather Studies course live as the curriculum for a five credit lab science Introduction to Weather and Climate course each fall since 1996 and the Online Weather Studies course totally online during 15 and 8 week sessions as an Introduction to Meteorology since 1999.

Introduction to Meteorology: Goals for the Course

The university introduction to meteorology lab course should be an experience that is rich in science content where many important critical thinking and analytical skills are acquired. Students should at the end grasp the fundamentals and have the experience of "looking at" a wide variety of weather through the internet, the media and their own observations. Bringing together the theoretical with the day to day practice of following the weather (and even perhaps trying one's hand at forecasting) makes for a lasting understanding that will enrich one throughout life. The goals of my introductory courses do not include turning students into meteorologists, although some do go on to additional formal study in the field. I attempt to provide students an understanding of science using meteorology as the focus and give them an appreciation of how the atmosphere works so they intuitively understand to a greater degree the day to day patterns of weather they experience and can use this knowledge in their daily lives.

Because everyone is interested in the weather, this is potentially easier to do with a meteorology course than other sciences. In a live class, it has been said, my enthusiasm for the topic and my presentation of the most interesting aspects is infectious and before long the students share in the enthusiasm. In an online course, particularly one where you and your students never meet, this is much more difficult. After several difficult semesters of not all that successful online instruction I have developed and honed skills for capturing the excitement, mobilizing student motivation and capturing the sense of community that created success for me in the live class setting.

Fostering an Online Weather Learning Community

The literature on Learning Communities suggests that certain shared learning experiences foster greater learning and result in greater student satisfaction that results in retention. (Shapiro and Levine, 1999; Love, 1999; Schroeder, 1996; Smith, 1994, 1991) UW Colleges has set as a goal the development of a number of learning communities, using different modalities. In most cases the communities are developed around the existing academic program so that students have ample access to required courses. Learning Community development is easier to accomplish in a live class where the typical learning community elements involve face-to-face interactions that get students to know each other and perceive that taking the class is a cooperative venture involving all of the students and the instructor. Asynchronous online courses can foster several of the elements by using technology to get students involved in group work, group interaction via a forum and live chat if the instructor takes advantage of these tools. Getting the student to depart from the typical view that an online course is essentially a one-on-one correspondence course between them and the instructor yields greater successes for students enrolled.

Early Communication

To maximize your opportunity for success it is important to start early! One should take the opportunity if possible to "meet" the students early. Modern courseware allows this to happen quite easily but one must first introduce the students to the

courseware, and to successfully do that, the instructor must be introduced effectively. I typically send all of my students a personal letter by post and e-mail (both to make sure it is read!) a few weeks prior to the start of the course. In it I introduce myself and set out some of the general goals for the course. I try to be upbeat and enthusiastic but also indicate that students will have to work hard to meet my goals. I inquire of them what their goals are (which in most cases is the completion of a degree requirement). Introduction to the courseware is next. I encourage students to log on early. In my course we use Blackboard *http://www.blackboard.com* courseware (many others use a variety of courseware including Desire2Learn, WebCT etc.) and the AMS Online Weather Studies website. I have the students explore both. I want them to be familiar with the mechanics of moving about the sites. I want them to know where things are and how to find things. I want them to be able to get back to some familiar place if they become lost. Most of my students are very adept at using the web and the courseware. Many are enrolled in an online degree program and have long experience with this. There are always some who are not, however. For these an early tour of the websites is crucial to prevent frustration, falling behind and the ultimate drop. I seek to retain every student!

Introducing the Courseware

Getting to know the courseware is crucial. Having dozens of students log on and make there way helter-skelter through the sites is not enough. I include a plan for the task so it is organized and everyone takes the same tour. The first stop is the course information page. This is the syllabus for the course which includes the schedule of assignments, the list of requirements, the books needed and the expectations. I include a quiz early on concerning this page to make sure they read it…if only while they take the quiz! I have the students stop at the assignments page. Here they get a sense of the typical assignment and how they need to do it in order to succeed. Since I routinely have fifty students enrolled there must be rules concerning how assignments are submitted to facilitate grading and managing paper flow. I go over these rules in this section. There are stops on the tour where the students introduce themselves to me and each other on the Forum, the tool in Blackboard that allows students to engage in asynchronous threaded discussions. They also must post a brief bio (and a photo if they wish) on the class list so everyone can review the "class" at a glance. In a way, this is like the look around the room students take on the first day in the live classroom. I also encourage them to initiate the chat facility so that those that have the time can see when fellow students are online and engage in discussion or just a quick hello. Bringing fellow students into one's chat group is a fine way to create community. Finally, I have the students post their location to a map which shows the locations of all enrolled. Since the online course has no borders, this helps the class to visualize the dimensions of its makeup. It also lets students know that synchronous communication is sometimes difficult with a classmate on the other side of the world.

Knowing one's way around the Online Weather Studies page is also crucial. This page is where the action is! Packed with weather maps and products and a host of links to other great weather sites, this is what some of the students have enrolled in the course

for! I lead them through a tour of specific links to weather products that they will visit routinely during the course and encourage them to visit the maps daily if possible even before we begin. The learning activities, created by AMS, will be the lab portion of the class and they must become familiar with the maps, diagrams and data they will be using to complete the labs. Furthermore, following the weather maps day to day allow students to quickly see that there are patterns to the weather and that they can relate the consistent weather products they see on the AMS Online Weather Studies page to the maps they seen on television, in the newspaper or on other websites. One of the requirements of the course is that students do follow the daily weather and that they share their own experiences as "reports from the field" with fellow students on the forum.

Motivation

Most of the students in an online class are quite highly motivated. This is particularly true if they are enrolled in an online degree program. These are working adult students striving to get ahead, looking to obtain job promotion or just a fuller view of the word through directed study leading to a degree. They will have set aside the time and energy to be fully engaged in the course. Some of them may balk at "joining the learning community" you try to create, preferring to go it alone and do just what is essential to meet the requirements of obtaining a good grade. It is important for these students to know early that full engagement in the learning community is required for a good grade. You must back this up with a reward situation that provides points for involvement as well as points for correct answers. Adequately rewarded, these students will provide the leadership of the "community" and valuable assistance to others less experienced online. Being in the leadership role is a powerful motivator. The less experienced students may also be more motivated because the leaders are setting a good example. Once an online learning community is established it is expected that every member do their best and assist the rest! Finally, motivation is built by the subject matter itself. Learning the weather concepts using real-time examples is a powerful motivator in and of itself. Even in the eight week summer session, when an archive of learning activities is used, following the weather daily puts the question "What happens next?" in the minds of the students. The expectation created by the serialized TV show or novel is an apt metaphor for the sense of excitement that is created when systematically following the weather day by day and learning how it works!

Students are also encouraged to share their personal weather stories. The past summer session the entire class was totally engaged as tropical storm, then hurricane Claudia churned through the Gulf of Mexico. Hurricanes are always interesting but this one was bearing down on the Yucatan peninsula where one of the students in the class resided. Sonja's version of "Storm Stories" riveted the students and instructor alike and brought the online community together in ways never before imagined. Her sharing energized the forum and chat room and prompted many others to share their experiences in weather from where they were. Students in this class were in Germany, Scotland, Costa Rica and Mexico and every region of the United States seemed to be represented. Interaction about weather at the global scale is motivating indeed!

Deeper Understanding

Atmospheric science, as all science, has several concepts that are particularly difficult to understand. It is important that students are provided the clearest of explanations in the text and that each lab has appropriate explanatory materials appended. I also think it is important that each student have at hand the tools necessary for complete understanding so I require that they purchase the AMS Glossary of Weather and Climate. While the standard Online Weather Studies package includes both a text index and glossary and an online glossary is available, I think it is valuable for the students to have in their possession a stand-alone resource book that provides information from a slightly different point of view. Requiring students to purchase yet another book is not a decision taken lightly. It has proven to be an important aid in allowing students to come to their own understanding quickly without having to wade through lots of other material or wait for an e-mail reply to a question.

Asking questions, of course, is an important facet of any class. In the classroom this is a very functional activity that results in understanding that goes out to all present. It also provides a mechanism for the development of follow up questions and conversations that follow that result in deep understanding. There is also the possibility that a question or discussion will bring to mind an experience or remembrance that provides the opportunity to tell a story. Students remember the stories. It is one of the most powerful teaching techniques. Our ancestors, religious leaders and even politicians have known that. Yet, online the good telling of stories is difficult. The conversation that leads to them is elusive. Even asking the questions and getting the answers is made difficult by not being physically together. This challenge is met by me by encouraging the use of the forum for all questions. I do accept e-mail queries but with the understanding that I will anonymously publish them to the forum with the answer. I also have some very good questions from past classes that I include as we reach consideration of the topics they cover. I fold them into the current questions so as to create a frequently asked question list included with the other questions the topic generates. Having this list, with all those questions to chose from, for each chapter and each difficult concept makes it certain that each concept is asked about and answered in a way that one responds to a live student inquiry. It also provides a suitable launch pad for my best stories which are embedded in the answers and also kept in a separate file to publish when the topic suggests. It has come to the point that my students groan (online) when I repeat the same story just as they do in the classroom! The give and take of question and answer and the personalizing effect of the storytelling help raise expectations ("If they are asking about that maybe I should give it some more attention!" "Wow, he really knows what he's talking about, having experienced that hail storm!") and bolster the feeling of community in the online setting where both are difficult to generate.

Increased Learning of Content

One of the criticisms of online lab classes is that they don't usually include the hands-on work of the traditional laboratory. Online weather studies does include several significant hands on activities for the students to explore difficult concepts. I enhance their use by augmenting these activities with some additional ones I have used in live labs over the years. In some cases where pictures are used in the lab manual I provide the instructions for the creation of simple paper and cardboard models that the students can build to provide a three dimensional hands-on experience that will provide more understanding than conceptualizing from a drawing will do. All hands on "props" utilize common, easy to find materials (even if one is studying in a location outside of the United States) that can be used to create simple weather instruments and apparatus for simple, yet powerful, experiments. I also make use of a variety of online activities, applets and animations that are designed for deeper understanding. Some of these are actually designed for other classes but serve the needs of the introductory class none the less. My rule of thumb is that things you can build and manipulate in your hands provide the most understanding and pictures and other learning objects on screen that move are better at getting across concepts than static drawings on screen or in books.

Greater Retention

In our online program in Wisconsin greater retention is the big goal. Typically forty percent of our online students drop the courses…many during the first two weeks. This is a tremendous loss in revenue to the university. Later drops are of more concern to me. They involve the loss of the students' time and money and often a considerable waste of my own effort in trying to get them to stay engaged. Greater retention of the information and skills to be learned is also an important goal. I want the students that accomplish the goals of the course to obtain more than good grades. I want them to take the most important parts of the course with them for the rest of their lives. After thinking about how to accomplish this in the first few times I taught online, I came up with a scheme that provided templates for sets of facts that I feel are crucial to an understanding of the discipline. I call these learning objects "big ticket items" because they cost a lot of the students' time and energy to learn but once learned last a long time in the students' memory and provide a big payoff in terms of that long range retention that is part of my goal. The learning objects are also big ticket items in terms of their value on exams. They must be learned and, if they are, there is a large reward in terms of points. They also provide a framework to add things learned later in life to the context of that learning within the class. This setup for lifelong learning is very valuable. I have about four of these items that are a part of the course (a few examples of these learning elements include "the recipe for clouds and precipitation," "possible causes of glaciation," and "the earth-atmosphere energy budget."). Introducing these learning objects for knowledge retention about one quarter of the way into the class has also had a great benefit for student retention. Students have commented on the fact that they welcomed these items which package information in a way that makes sense and helps relate it to other learning. They also get a sense of satisfaction that comes from mastery. The discussions and strategizing that occurs on the forum concerning how to learn this material also helps build community.

Conclusion

Success in online science instruction requires proper preparation and increased early in the course effort on the part of the instructor. These efforts are focused on getting the students engaged early, calming fears by building familiarity with the course and skill building so students can effectively use the technology. Building an online learning community is essential so students gain the motivation derived from "belonging to the class group" rather than moving through the materials alone. Strategies to personalize the course through prompt and effective instructor communication and assistance also help build this community. The course itself must be designed to utilize the technology as well as learning objects students can use off line so that deeper inquiry and understanding result and so considerable content is retained. Successful retention of students in the course and their ultimate success in it is the result.

Literature Cited

Brey, J.A."Ethical Consideration in Land Use; An Exploration of Values in the Prison Lab Science Classroom" in *The Journal of the Correctional Education Association Leadership Series in Correctional Education*. Edited by R. K. Vitolo. Los Angeles: Correctional Education Association, 1987).

Brey, J.A. and L. S. Campbell. "The Pinellas County Land Use Planning Project; An Innovative Modular Lab for Use in Corrections and Adult Education" in *The Proceedings of the U.W. System Conference Teaching Behind Bars; A Model for Adult Education*, ed. Rebecca Ferguson, (Madison: U.W. Centers, 1988.

Love, A. G. "What Are Learning Communities?" In *Learning Communities: New Structures, New Partnerships for Learning*, edited by J.H. Levine. Columbia: National Center for the First Year Experience and Students in Transition, 1999.

Schroeder, C.C., and J.C. Hurst. "Designing Learning Environments That Integrate Curricular and Co-curricular Experiences." *Journal of College Student Development* 37 (2) (1996): 174-181.

Shapiro, N.S. and J. H. Levine, *Creating Learning Communities: A Practical Guide to Winning Support, Organizing for Change, and Implementing Programs*. San Francisco: Jossey-Bass, 1999.

Smith, B.L. "Team Teaching." In *Handbook of College Teaching*, edited by K. Prichard and B. Mclarn Sawyer. Greenwood Press, 1994.

Smith, B.L. "Taking Structure Seriously: The Learning Community Model." *Liberal Education* 77(2) (1991): 42-48.