ONLINE WEATHER AND OCEANOGRAPHY: MEETING THE NEEDS OF A DIVERSE STUDENT BODY AT ALASKA PACIFIC UNIVERSITY

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1. Introduction

Alaska Pacific University is a small private institution located in Anchorage Alaska serving a diverse population of students. It is the only private institution in Alaska with a residential campus. Student groups served include traditional residential students, adult learners who live in Anchorage, and adult learners who live in rural Alaskan villages. Major areas of study include environmental science, with majors in marine biology and earth science, education, psychology, liberal studies, business, outdoor studies, and education. Over the last decade traditional courses in weather and oceanography have been modified using American Meteorological Society (AMS) curricular materials to serve this diverse group of students through both fully online and blended courses. AMS curricular materials utilized include textbooks on weather (Moran, 2009) and oceanography (Moran, 2008), corresponding workbooks (AMS, 2009) in each of these subjects, and comprehensive interactive web sites maintained by AMS. AMS materials provided a foundation upon which a suite of courses in the earth sciences was developed to satisfy general university requirements for non-science majors as well as upper division courses for science majors. This paper will describe the features of each of these courses, how they compare and how they differ, scheduling of classes, and ancillary materials used in conjunction with AMS materials to provide for the needs of different groups.

2.1 Online Courses as GUR

Use of AMS material at Alaska Pacific University started in fall of 2002 and was expanded two years latter when the university needed to deliver a lab science course as part of its distance education program known as RANA. RANA stands for rural Alaska native adult program. This program is structured for students living in both remote Alaska cities such as Nome, Bethel, and Barrow and small villages scattered throughout Alaska. The challenge for the university was to offer a laboratory science course to meet a general university requirement (GUR). Rather than try to adapt basic science courses such as biology, geology, or chemistry for use, we decided to use AMS's online weather course to provide students with a science laboratory experience.

The basic weather course and textbook consists of twelve chapters and a companion workbook that includes both archived and real-time data for workbook exercises. The most challenging aspect of course delivery was to put in place a course

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management system(CMS) that afforded both the students and instructor adequate communication as students worked through the material. Initial offerings of the course depended on a continual flow of emails between the instructor and the students as the latter learned the material. During the initial course offering several valuable lessons were learned. Among these were that students needed to network so that information passed on from the instructor to an individual student could be shared among the classmates. This resulted in students using each other as resources rather than solely depending on the instructor. It also became apparent that a course management system (CMS) was essential that allowed PowerPoint presentations, as well as delivery of weather maps and other images to demonstrate weather concepts. Alaska Pacific University adopted the free open source CMS Moodle and contracted with a another institution to use Elluminate. In offering the online weather course the ability to deliver real-time images and verbal explanations is of paramount importance. Because the course is highly dependent on maps, charts, graphs, and other imagery and non-science majors have limited experience working with this type of information, it is critical to have a CMS in place that can deliver imagery accompanied by verbal explanations. A good example of this is in the initial stages of the course where Stüve diagrams are introduced. While most students are comfortable using a common Cartesian coordinate system, the Stüve diagram requires students to follow lines at angles and choose different lines for various atmospheric conditions.

Using Moodle, weekly chats were arranged in which the previous week's lesson could be reviewed and the upcoming week's lesson previewed. The most beneficial aspect of the initial course offering was working through the material along with the students and identifying where problems arose and areas that would present difficulty for the students. Because the core material changes minimally each year, instruction can be targeted to address anticipated problem areas and difficult concepts before the student encounters them "cold" in the reading material or exercises. An added advantage of the delivery system chosen was that each presentation could be recorded so that students who missed class could view the entire class as though they were there. Students who missed class are required to submit a written review of the class in order to receive credit for attending the class. Additionally, students who had attended class and didn't grasp a particular concept could go back and review portions of the presentation.

While the use of AMS's curricular material can be used without modification, I felt that examples relevant to Alaska needed to be included to help students see the connection between the concepts they were learning and the weather they experienced. In this sense, I believe each instructor using online weather or oceanography studies needs to regionalize the online weather course to make the material more relevant to students in their area. Regionalizing the online weather course can be done

in numerous ways. A review or requirement to read NWS reports for the area is a simple way to make the students aware of local conditions. More formal methods that can be taken by instructors include examining each week's lesson and using the links on the AMS course web site to utilize local data in addition to or in place of generic data used in the workbook. This can be as simple as looking at Stüves for the closest city to determine the height of the tropopause, examining the jet stream over a particular area, analyzing El Niño or La Niña impacts on local climate, or looking at degree heating (cooling)-days for your area.

2.2 Blended Courses for Science Majors

Alaska Pacific University's weather offerings by 2005 consisted of a general education course at the 100-level entitled Introduction to Meteorology and a 300-level course entitled course entitled: Meteorology: Weather and Climate. The former was delivered as a fully online class, while the 300-level class was taught as a blended class. The 100-level class is taken almost exclusively by adult learners in either the RANA program or the degree completion program (DCP); the latter consists of students who have at least one half of their undergraduate requirements completed and intend to finish their degree after an extended absence from college. The blended 300-level class consists of traditional students enrolled in a science program. The first time the 300-level was offered using AMS's materials it was offered as a fully online class, but I made myself available to the students for a two-hour block each week. During this time students could come in and resolve any problems they were having with the course material. While several students took advantage of this arrangement, most students made little contact with the instructor throughout the semester and several missed assignments and fell behind. Subsequently, all students are now required to attend a two-hour weekly class. This helps to keep students focused and greatly eliminates procrastination. Additionally, it allows me to introduce additional material beyond that provided by AMS.

In order to justify 300-level credit material additional requirements and activities were added to the basic AMS curriculum. One requirement was completing the three additional chapters that are part of the online studies workbook. Another requirement is to complete a project related to the course material. Each student selects a project relevant to individual goals and no particular constraint is placed on the topic other than the student must show how it relates to the course. Some examples of projects include construction of a wind turbine for use with school children, analysis of air pollution data, establishing a home weather station, measuring snow depths associated with different microclimates, review and analysis of weather related media such as the films *Twister* or *The Perfect Storm*, review of a weather-related book such as *Isaac's Storm*, and writing a brochure to educate hikers, kayakers, etc. on backcountry weather. Lastly, the blended format in which students meet as a group for

two hours each week, allows students to have direct hands-on experience using various weather equipment as well to participate in field trips. Students use simple equipment such as rain gauges, psychrometers, temperature loggers, pyranometers, and wind gauges to experience data collection. Field trips include attending a rawinsonde launch, attending a taping of the local PBS's weather broadcast, or visiting an air pollution monitoring site.

2.3 Online Oceanography

In the fall of 2006 Alaska Pacific University adopted AMS materials for use in its oceanography course. Oceanography materials were used to construct courses that paralleled our experience in designing the weather courses: a fully online 100-level GUR oceanography course and a blended 300-level science majors oceanography course. As with the weather courses, the oceanography courses were regionalized to make them more relevant to Alaskans. Examples include examining tides in Cook Inlet as a renewable energy source, examining ice cover in connection with global warming, and looking at beach erosion in coastal Alaska villages. With respect to upper level activities that enhanced the course for science majors, students are presented with lab work in which they analyze for salinity using several different methods, analyze beach sands from both local and remote beaches, measure productivity, and examine the transmission of light in water using a Secchi disc.

The 100-level GUR oceanography course has been particularly amendable to incorporating local topics and traditional knowledge of Alaskan native students. In this sense, students appreciate the opportunity to contribute material upon which they have a unique perspective. For example, one unit in the online oceanography examines sea ice and its distribution, especially in regard to global warming. Students who have lived in coastal Alaska villages their entire life can make valuable observations that may support or refute general information presented in textbooks and web sites. Likewise, they can relate this information to their culture and share how this has affected hunting practices and subsistence. The decrease in sea ice is also related to the opening of the Northwest and Northeast passages and how this could promote trade and commerce in coastal Alaska communities. Another aspect of regionalism pertinent to the course is the definition of the continental margin and how opening of Arctic regions in recent years with the melting of sea ice has renewed national interest in bathymetric studies. These studies are done to determine national boundaries that extend into mineral rich Arctic oceanic regions.

2.4 Online Course to Fulfill Lab Requirements

Approximately two years ago AMS materials were again utilized to satisfy a specific need of transfer students. The graduation requirement for Alaska Pacific University includes a

4-credit hour laboratory science course (3 hours lecture + 1 hour lab). A significant number of students transfer to APU with a science course that did not include a lab. Because all lab science courses at APU are taught as an integrated course and many of our transfer students have been out of school for a number of years, it is impractical for students to merely sign up for the lab portion of a basic science course. Until two years ago in order to fulfill the 1-credit hour laboratory requirement, transfer students would arrange an individualized 1-credit hour directed study lab course. While this type of arrangement enabled transfers to meet the lab requirement, it required excessive faculty time to arrange and supervise the experience. Two years ago we developed a 1-credit hour lab course based on weather. All of the transfers needing the lab course were non-science majors and each student had at least three credit-hours of science, but the transferred science courses spanned the range of disciplines comprising science. It was determined that the topic of weather provided enough broad interest and incorporated enough material from the basic sciences to make it a logical choice for a generic 1-credit hour lab course. The course was based on AMS's online weather studies workbook. The workbook provides enough background material to guide students through the exercises. Students work through the exercises at their own pace and an instructor is available to provide guidance if the student needs help. The course has been a successful in meeting both student and institutional needs. Students enjoy learning about weather, a subject they have no difficulty relating to, and can see immediate applications of what they are learning in daily media weather reports.

3.0 Summary

From its inception in 2001 the transformation and expansion of APU's weather and oceanography courses has been made possible by using AMS's curricular materials to provide a foundation for each individual course. These courses are tailored to serve different student groups and are summarized in Table 1. As noted in Table 1 oceanography courses are offered in the fall and meteorology courses in the spring. AMS curricular materials have been essential in being able to offer a suite of related but diverse courses in meteorology and oceanography. Developing and delivering these course takes a coordinated effort, and any institution considering to expand their offerings using AMS materials should consider how best to tailor the material to meet their needs. In developing these courses a number of valuable lessons were learned and changes are still taking place. For example, the next offering of the 300-level meteorology course will include utilize several modules from COMET® to further expand upon AMS materials. COMET® is a program operated by the University Corporation for Atmospheric Research (UCAR) and has numerous online course and modules related to meteorology and oceanography posted online (http://www.meted.ucar.edu/).

In summary the following suggestions are made to instructors

considering use of AMS material in their courses: 1) A quality CMS is essential if the course is to be taught in a fully online format, especially important is the ability to present images and interact with these images electronically during presentations. 2) Regionalizing materials makes them more relevant and creates a closer connection to concepts presented. Instructors need to be selective in incorporating local information and carrying this concept too far can undermine the course's general philosophy of an Earth's systems approach in which concepts are examined from a global perspective. 3) Periodic (weekly) meetings are essential to stay in touch with students and emphasize the fact that learning the material requires discipline and regular attention to the lessons. Too often online and blended courses that do not have a regularly scheduled class meeting several days per week are neglected and the subject matter is digested in an episodic fashion. Associated with the periodic meetings is having firm due dates with material due on at least a weekly schedule. This not only requires students to keep up with the material, but also is consistent with using real-time data to teach concepts. 4) Instructors teaching upper level science courses should enhance AMS materials with labs, projects, and supplementary materials that build on the basic information and concepts embodied in AMS weather and oceanography studies. As noted one simple method of doing this is incorporating COMET modules into a course. It should also be noted that instructors whose backgrounds may not be strong in meteorology or oceanography and want to have a better understanding of particular concepts can use COMET modules. 5) The workbook can act as a stand-alone resource to meet the needs of particular students. Although the workbook does not provide the comprehensive background behind the exercises, it does provide enough of a background so that most students are guided through the book. I have found even students with weak science and math background need minimal help in working through workbook exercises, especially if they are aware of AMS supplementary material, e.g., glossaries.

4.0 References

American Meteorological Society., 2009: *AMS Ocean Studies Investigation Manual.* American Meteorological Society.

American Meteorological Society., 2009: *Weather Studies Investigation manual.* American Meteorological Society.

Moran, J. M., 2009: *Weather Studies: Introduction to Atmospheric Science, 3rd Edition.* American Meteorological Society, 516 pp.

Moran, J. M., ed., 2008: *Ocean Studies: Introduction to Oceanography, 2nd Edition.* American Meteorological Society, 474 pp.

Table 1 Overview of Alaska Pacific University's Weather and Oceanography Courses

Course	Title	Group Served	Schedule	Format	Main Requirements
SC 11500	Basics of Weather Laboratory Investigation	Transfer students	Every term	fully online	AMS workbook only
SC 15500	Introduction to Meteorology	Rural students	Spring	fully online	AMS
SC 15500	Introduction to Meteorology	Residential lower division, Early Honors (high school seniors), non-science majors	Spring	blended	AMS
SC 35500	Meteorology: Weather and Climate	Residential, science majors	Spring	blended	AMS + Ch. 13-15 +Project +Labs
SC 15000	Introduction to Oceanography	Rural students	Fall	fully online	AMS
SC 15000	Introduction to Oceanography	Residential lower division, Early Honors (High school seniors), non-science majors	Fall	blended	AMS
SC 35000	Oceanography	Residential, science majors	Fall	blended	AMS + Ch. 13-15 +Project +Labs

AMS = AMS Textbook and Workbook Chapters 1-12