STRATEGY FOR IMPLEMENTATION OF THE AMERICAN METEOROLOGICAL SOCIETY'S (AMS) CLIMATE STUDIES COURSE AT UNIVERSITY OF HOUSTON-DOWNTOWN (UH-D), NATURAL SCIENCES DEPARTMENT IN FALL SEMESTER, 2013

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Introduction

Subsequent to my participation at the AMS Climate Studies Diversity Project Workshop held at Washington D. C. in May 2013, all faculty representatives from universities in North America were mandated to initiate implementation of the AMS Climate Studies course to be licensed for adoption in their various institutions. This course is now ready for implementation, and has commenced to feature on the regular course schedule at UH-D's Natural Sciences Department from fall semester, 2013. The AMS Climate Studies course is offered through a teaching approach referred to as "Project Based Science" that seeks to engage students in exploring the world through reading, lectures on scientific principles, working on hardcopy and electronic computer database consisting of "real-time" climate, weather, and ocean database. The overall processing data systems for course implementation include the Blackboard Learning Management Systems (LMS) with various interactive components that connect relevant links to the AMS website for real-time reports and lab investigations exercises.

Historical Background on UH-D's Relationship with AMS Education Program

The history of teaching the AMS version of Weather Studies at the Department of Natural Sciences of UH-D dates back to Year 2004 when it began with one section consisting of 25 students. Student's enrollment has grown steadily to fill three sections of Introduction to Meteorology (GEOL 1304) by fall semester in 2009. Most of the students have been typically non-science majors, of diverse and minority origin, and have weak analytical skills but enrolled to fulfill a general science requirement for their various major degrees. The Ocean Studies course was later developed (as GEOL 1345) to be taught as a fully online course in fall, 2009 at UH-D's Natural Sciences department. Accomplishments offering AMS courses include a tremendous increase in retention of minority students, while the AMS Weather Studies course has become one of the most popular options among other traditional physical sciences in the Department. The student-centered instruction technique has been adopted to actively engage their minds, with lots of peer interaction, plenty of formative assessment integrated with instruction, and a focus on concepts. The learner-centered strategy is enhanced by learning from visualization plus reference to current weather events and oceanographic issues,

particularly extreme weather conditions as they impact on society and the environment. The well-researched learner-centered instructional technique has functioned effectively as an interactive and engaging approach that involved collaborative group cooperation.

Lessons learned from past experiences reveal that Faculty should engage in continual improvement including goal-oriented techniques that are designed to enhance student outcomes and teacher satisfaction. Achieving teaching excellence takes time, requires honest reflection on student's feedbacks, plus repeated revision, and fine-tuning efforts. A major achievement is witnessed in higher retention rates, and passive students have ultimately turned into active learners with a renewed sense of appreciation for Weather and Ocean sciences.

Objectives of the Poster Presentation

The main objectives include:

1. A review and appraisal of the AMS Weather, Ocean, and Climate Studies courses including the Diversity Project based on courses offered at the University of Houston Downtown (UH-D); and thereby develop the strategy for implementation of the new AMS Climate Studies course; and

2. Evaluate the instructional strategies employed in teaching the various courses from lessons learned in the past to facilitate future AMS educational programs

Instructional Methodology

Instructional method is a learner-based, self-inquiry, engaging approach that involves "hands-on" investigations, lab exercises, visualization materials, and simulation models to prompt critical thinking which facilitates learning of concepts. This will be based on an integrated lecture-lab structure that will enhance interactive peer participation, and encourage collaborative group cooperation. This course will focus on the (1) emergence and practice of the modern scientific method; (2) major scientific discoveries and their role in the development of modern science and society; (3) and the interaction of modern science and society. This course will also illustrate how scientists observe, develop questions, and interpret the natural world in an integrated manner across all disciplines of science. Students will also explore how science influences the world-view of Western culture and the role of politics, ethics, and technology in the development of science. Lab sessions will focus on how scientists make and interpret measurements of natural phenomena; and will provide exercises in using the scientific method including the interpretation of data; various ethical and practical problems such as

nuclear energy, genetic engineering, and land abuse and population pressures. This course involves study of the Earth-Atmosphere interactions, its composition, structure, and properties with emphasis on the processes responsible for weather, climate controls and change, and the impact of atmospheric phenomena on society. Students will collect, analyze online real-time weather and climatic data in order to understand climate, and climate variability. Climate Studies provides students with a comprehensive study of principles of Climate Science while simultaneously providing classroom and laboratory applications focused on the rapidly evolving interdisciplinary field of Earth's Climate System. Students will be informed on Earth's climate system, regional/global atmospheric circulation, the scientific principle that governs climate, climate variability and climate change with implications for society. Other topics include risk management strategies aimed at countering the negative impacts of global climate change.

Students Learning Outcomes

Students will (1) utilize the scientific process to identify questions pertaining to natural phenomena, (2) develop hypotheses, (3) collect and analyze quantitative and qualitative data, (4) collaborate in the evaluation of the quality of scientific evidence from multiple perspectives toward the goal of reaching a shared objective, and (5) communicate analyses and results using written and oral communication. After completing this course, students will 1) understand the scientific process and how problems are solved in science; 2) understand how science provides explanation of cause and effect relationships in natural phenomena; 3) be able to apply scientific reasoning to observations of natural phenomena; 4) understand the history of important concepts in the natural sciences; 5) understand how science is perceived by society, how the history of science and our modern world are intertwined, and how science continues to impact society today; 6) be able to distinguish arguments that are based on scientific reasoning versus those that are not.

Appraisal of the Course Implementation Workshop on AMS Climate Studies Diversity Project

The Course Implementation Workshop on AMS Climate Studies Diversity Project effectively prepared us and provided valuable presentations and instructional materials to be used for ultimate delivery of the new AMS Climate Studies course at our various institutions. The course curriculum was basically developed by the Education Program of the American Meteorological Society (AMS), funded by the National Science Fund (NSF) with support and assistance provided by the National Aeronautics and Space Administration (NASA). It is closely aligned with the essential principles of climate science and identified in a recent climate literacy initiative by the National Oceanic and Atmospheric Administration (NOAA) and the American Association for the

Advancement of Science (AAAS). The course is unique in that it will be done using the most current climate data that AMS Education Department will write exercises based on the weather, ocean, and climatic issues of that day. Academic and practical activities of the Course Implementation Workshop included field trips, technical, and professional presentations on the current "State-of-the-Arts" technology in Climate Science. Topics in the frontier areas that enhance course implementation include instructional procedures on AMS Conceptual Energy Model; integrating AMS Climate Studies with our course management system through "Respondus"; Climate Change and Climate Variability. We were engaged in valuable and educative field visits to NASA; NOAA; AAAS; NCEP; Beltville Climate Center; Weather and Ocean Prediction Center Operations Area tour in Washington D. C.

The Short- and Long- Term Strategic Plans

The short-term strategic plan for full implementation at UHD is to initially offer the new AMS Climate Studies course (GEOL 2390) from fall 2013 as a science elective for mainly non-majors to fulfill their Bachelors' degree requirements, while the long-term goal is to ultimately schedule the Climate Studies course as an introductory college science degree option towards the Bachelor's degree in Geoscience at UHD's Natural Science Department. It is noteworthy to mention that we earlier started to offer the AMS equivalent Weather and Ocean Studies courses (GEOL 1304 and GEOL 1345 respectively) since Year 2004, and have been very successful while it increased steadily to six sections, currently including face-to-face and fully online versions.

Lecture Strategies will be student-centered instructional techniques for engaging students to promote active learning. The learner-centered strategy will be enhanced by technological applications such as PowerPoint presentations, triggered animations with sounds, visualization, collaborative inquiry-based learning, science assessment and goal-oriented grading technique. All these items will be used as catalysts for students' success and motivation as revealed by the remarkable growth in the AMS Weather and Ocean Studies programs at UH-D since inception. The classroom full capacity (for face-to-face sections) will be restricted to a maximum of 25 students per class to retain a sense of community existing by default such that all members know each other's names. The online sections enrollment will be increased to 30 students per class for hybrid or fully online classes to maximize student's population. Individual student will be accountable to their instructor and to each other simultaneously. This setup will eventually facilitate motivation for active learning and peer group interaction in the class. The collaborative instructional method in classrooms would promote active instructor-student close relationship, and enable both parties to gain a renewed sense of enthusiasm for teaching and learning respectively.

The existing field projects on weather balloon launching will be expanded to measure, and acquire, weather parameters including temperature, pressure, humidity, precipitation..., and specifically monitor and plot the ozone levels along the Gulf Coast to be compared to other regions of North America. Our balloon group at UH-D has in the last four years been involved with ozone level monitor surveys in the Gulf Coast, and Upper New York State. The objective is to eventually establish a regional ozone level profile for comparison and lead to study the impact on the atmospheric air, pollution and climate.

Discussion *and Conclusion*

The instructor-student relationship can be described as that of "Digital Immigrants" versus "Digital Natives" because of the generational gap the exists between both in terms of familiarity with the "state-of-the-arts" technological development. The advantage in this development is that the students are familiar with current technology, and should be encouraged to use them to enhance their learning. The future of college science instructions will depend to a great extent on breaking new grounds in cutting-edge approaches and technologies. The new generation of students is more comfortable with interactive digital systems, visualizations, videos, and interactive learning. Critical thinking has to be activated by techniques that could prompt students into active learning such as collaborative inquiry-based techniques. A combination of some of these strategic techniques has proved effective in prompting teaching excellence over time. This has resulted in student's motivation for active learning, and enhanced teacher satisfaction.

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