

“Curriculum Expansion for AMS Weather and Ocean Studies at the University of Houston (UHD)”: A Poster Presentation on Education at the American Meteorological Society (AMS) Annual Meeting held in Atlanta, GA, 16 – 21 January, 2010

(Ayorinde Idowu, Department of Natural Sciences, University of Houston Downtown Houston, Texas)

Abstract

The history of teaching the AMS version of Weather Studies at the Department of Natural Sciences of UHD 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, and I am involved with integrated lecture plus laboratory courses to date. I have also taught full Online AMS Weather and Ocean Studies courses at the Houston Community College System (HCCS) since Year 2004, while student’s enrollment has equally grown substantially to date. 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. I was recently mandated to participate in the Faculty curriculum development of a new course titled Oceanography (GEOL 2390) which I started to teach in fall 2009. This event ushered in a breakthrough, and a major achievement is that this is a sophomore level course designed based on the AMS Ocean Studies for the first time for both science- and non-science majors. It constitutes part of the major degree curriculum in the Department of Natural Sciences at UHD.

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 Study

The objectives include:

1. A review and appraisal of the AMS Weather and Ocean Studies including development of the Diversity Project based on courses offered at the University of Houston Downtown (UHD); and thereby
2. Evaluate the instructional strategies employed in teaching the various courses, and lessons learned for advancement of future AMS educational programs

Mission Statement of the University of Houston Downtown (UHD)

The University of Houston-Downtown (UHD) is a public, urban university committed to providing quality academic programs that serve the needs of multicultural population of Houston and surrounding communities. It offers both undergraduate and a limited number of graduate academic programs that enable students to acquire the knowledge and skills needed to succeed in their chosen fields. Through instructional excellence, creative scholarly activities, and community involvement, the university contributes to the business, scientific, economic, technological, social and cultural development of the area.

As an urban university, UHD has the responsibility to provide educational access to those who have not had access in the past. Through flexible scheduling of courses, the innovative use of technology and distance learning opportunities for many who might have not otherwise be able to pursue a college degree. To facilitate the academic success of both its traditional and nontraditional students, the university offers a wide range of support services and employs a faculty and staff who are dedicated to helping students meet the rigorous standards and requirements for its programs.

In its public service and outreach activities, the university offers numerous pre-collegiate programs as well as continuous education programs that maintain and upgrade specialized skills of professionals employed in the Houston area. Through selected programs, research initiatives, and collaborative efforts, the university also seeks to broaden its domestic and international academic programs and relations.

UHD: Historical Background

Today UHD is the second largest institution in the University of Houston System, which includes four distinct universities: the University of Houston, UH Clear Lake, UHD, and UH Victoria. All four institutions are governed by the UH System Board of Regents. The chief administrative officer at each university is its president.

Like its students, the university mission is driven by a passion to carve out the future, looking ever forward, continually reaching and discovering. Academic program have multiplied from

only one in 1974 to more than 40 bachelor's programs today. UHD's number one priority has been the success of its students all along the way. UHD students mirror Houston's dynamic community, and represent a wealth of cultures, languages and nationalities. They excel in areas that address the world's economic and social challenges. Like Houston, UHD is powerfully drawn to the future. It accepts the challenge to make things happen, celebrates its diversity, and keeps its vision broad.

Catalogue Description: Introduction to Meteorology (GEOL 1304)

A course for non science majors focusing on the study of the atmosphere, its composition, structure, and properties with emphasis on the process responsible for weather, climate control and change, and the impact of atmospheric phenomena on society. Students will collect, analyze, and synthesize online, real-time weather data in order to understand current weather conditions, and be able to make prediction about future weather circumstances. This course is offered as an integrated lecture-lab science option.

Catalogue Description: Oceanography (GEOL 2390)

A course designed for both majors and non science majors focusing on the study of the science of the world's oceans in all ramifications. An introduction to the world's oceans, emphasizing the geological, physical, biological, chemical, and ecological aspects of the marine environment, and the role of the ocean in moderating global temperatures. The subject materials will relate the marine waters to impacts on society, and the effect of global warming. Students will collect, analyze, and synthesize online real-time marine data to understand ocean sciences. The course is offered at the sophomore level as an integrated lecture-lab option

Strategies for getting students Engaged

The AMS Online Weather Studies program was first adopted at UHD in 2004 and taught as an introductory college level course to date (GEOL 1304, Introduction to Meteorology), while enrollment consisted of mainly non science majors. The majority of the students typically had little or no math or science background, and of diverse origin, and have weak analytical skills but enrolled to fulfill a general science requirement for their various major degrees. An instructor in this environment would feel you almost have to "do cartwheels" in class to get student's attention. Students generally cannot make sense of their textbooks and test poorly even when the tests are open book, and students would not persevere to think critically.

In the process of time, it became evident that new strategies and innovative methods had to be used to engage today's students and promote active learning. Various instructional technologies adopted involve cutting-edge approaches and effective assessment for success. The instructional technique proved to be affective for the current generation, and exploration of new communication technique enhanced active learning. The students are encouraged to observe, discover, and visualize in the process of learning basic scientific concepts. The students are

guided in collaborative inquiry methods to make sense of dense texts, while instructors can make their own thinking processes visible to students, increase student self-confidence, and foster more student engagement and critical thinking.

Use of Technology for Lectures & Lab

Appropriate exercises in science lectures and lab proved to be well suited to the incorporation of technology to enliven the science class.. Multimedia techniques allow for inclusion of current topics, the incorporation of animation, and sound to clarify complicated concepts, improve communication and interaction. Since the non science majors generally perceive that they do not like science and technology, it is vital that instructors should orient and assure them that they can receive help to learn science. Students are encouraged to activate individual practical skills by referring them to access current scientific items in the Internet, create their own videos, use puzzle makers and crosswords to learn science.

PowerPoint slide presentations effectively facilitated interactive activities in the classroom for both lecture and lab demonstrations. It proved to be the prime tool for classroom presentations, and has a hidden potential for truly interactive learning activities, motivational illustrations, and even games. Most non science majors are usually encouraged to participate in learning experiences from an entry-level science class in which motivation plays a key role for teaching and learning success. In this context, the PowerPoint has been an effective tool for students' motivation to discover scientific concepts.

It was observed that students initially perceive PowerPoint presentations as boring, and often a copy of the textbook. They are also considered to contain too much information, including diagrams, or equations harder to understand when not well developed. These problems are however resolved by continuous improvement, making them easy to generate including update of activities charted with appropriate illustrations in the right sequence. Animations for an example, are simplified into logical steps, while additional accessories such as “triggers” with clickers are used to produce sounds to enhance student's motivation and interactive learning.

Inquiry-Based-Learning

Inquiry-Based-Learning is about how instructors can harness student's natural curiosity to deepen understanding. The techniques range from learning how to ask leading questions, to adding “activity-brakes” in lecture, to engaging students in their own explorations. Questions are used to build understanding by organizing lectures, labs, and discussions around questions. Each class period or exercise is constructed around a series of leading questions. Some of these questions are verbal, others involve probing or interacting with our environment. Such questions arise naturally from a basic curiosity or comparison of what we know and don't know. Questioning helps us to connect the new information we gain about the world with what we

already know. This process encourages curiosity, learning through questioning, and critical thinking amongst students.

Our students eventually learn to engage in collaborative inquiry about varied reading processes and to foster “metacognitive” conversation in the classroom. They also learn to make the complex, invisible thinking processes that I use as an expert reader in my discipline visible to students. Students are apprenticed to the disciplinary ways of reading and thinking that are necessary for success in college. They are also taught to acquire an understanding of reading apprenticeship as an instructional framework, and learn to make changes in classroom practice to build on students’ strengths as readers and learners simultaneously.

Effective Grading and Assessment Strategies

Grading is a context-dependent, complex process involving evaluation, communication, motivation, and organization. Assessment is the systematic gathering and analyzing of information to inform and improve student learning or programs of learning in the light of goal-oriented expectations, the following outcome measures are typically set to ensure objectivity, consistency, and accountability in determining:

1. the degree of mastery of the courses discipline contents;
2. the students ability to understand scientific and technical information; and
3. the students resulting course grade

Assessment is effectively used to improve student learning in the light of goal-oriented expectations. An institutional success and faculty satisfaction can be accomplished when the instructor has identified and addressed relevant strength and weaknesses. Fair grading of tests is of utmost importance, and makeup tests should be allowed since some students perceive these as fairness. It is beneficial to regard the grading system as a means to measure both student’s motivation and faculty satisfaction. Good assessment is in order of ranking importance, using multiple measures as yard stick, engagement of students that are highly motivated, and having the highest potential to “close the loop”.

Comments and Conclusion

A number of integrated strategic techniques have been adopted to effectively enhance active learning and subsequently acquire a high level of motivation for enrollment in the AMS Weather and Ocean Studies at UHD since inception in Year 2004 to date. Student’s enrollment in the introductory college level grew steadily from one section at the beginning to two sections in 2005 and 2006 to reach the current highest of three sections from 2007 to date. Most of the students have been non science majors, of diverse and minority origin, and initially had weak analytical skills. They enrolled to fulfill a general science requirement for their various degrees.

The student-centered instructional techniques proved to be effective in engaging these students to promote active learning. The learner-centered strategy was 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 acted as catalysts for students' success and motivation as revealed by the remarkable growth in the AMS Weather and Ocean Studies programs at UHD since inception. The classroom full capacity was restricted to a maximum of 25 students per class hence retained a sense of community existing by default such that all members know each other's names. Individual students, are therefore accountable to their instructor and to each other simultaneously which served as motivation for active learning and interaction in the class. The collaborative instructional method in classrooms automatically brought both instructor and student closer, while both parties gained a renewed sense of enthusiasm for teaching and learning respectively.

The instructor-student relationship can be described as that of "Digital Immigrants" versus "Digital Natives" because of the generational gap that 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. A curriculum expansion has started at UHD Department of Natural Sciences with the attainment of highest level of three sections of AMS Weather Studies courses (i.e. GEOL 1304, "Introduction to Meteorology") plus establishment of a brand new course in 2009 fall semester adopted from the AMS Ocean Studies program. This new course, Oceanography (GEOL 2390) is offered as a sophomore level course by the Natural Science Department at UHD. Other major achievements include retention rate for students of diverse and minority origin. These students from diverse background, and hitherto with passive attitude to science because of non science and weak analytical skills, have turned into active learners with a renewed sense of appreciation for Weather and Ocean studies.

References:

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