Integrating Climate Change Studies Course in the Undergraduate Program- An effort to Develop Minority Young Scientists in STEM Field

Buddhi Gyawali,
Maifan Silitonga, and Ken Bates,
College of Agriculture, Food Science and Sustainable Systems
Kentucky State University, Frankfort, Kentucky

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ABSTRACT

Kentucky State University (KSU) is an 1890 Land Grant institution with diverse liberal studies and science, environment and agricultural programs. Currently, KSU offers six undergraduate degrees in the STEM-related field: (1) Bachelor of Science in Computer Science, (2) Bachelor of Science degree in Applied Information Technology, (3) Bachelor of Science in Chemistry, (4) Bachelor of Science in Biology, (5) Bachelor of Arts in Mathematics, and (6) Bachelor of Science in Agriculture, Food and Environment (AFE). Kentucky State University (KSU)'s College of Agriculture Food Science and Sustainable System (CAFSSS) is developing a minor in Environmental Systems in its newly launched undergraduate program in AFE. The primary objective of this plan is to produce competitive young scientists in environmental science occupations. This objective will be accomplished through developing a series of academic, instructional, scholarship, and curriculum development initiatives. The CAFSSS needs to develop new courses and recruit more faculty. In support of this effort, CAFSSS is planning to offer an undergraduate course in Climate Change Studies from Spring 2013. The instructor for the course has recently attended AMS' Climate Change diversity workshop in Washington D.C and is well-prepared to teach the course. After the completion of the course, students will have elevated knowledge and techniques to use for scientific research and decision making, as well as, make them more competitive in the area of atmospheric science, weather forecast, and designing public policy for adaptation and mitigation of climate change effects.

INTRODUCTION

As recommended by National Science Foundation's (NSF) report on "Women, Minorities, and Persons with Disabilities in Science and engineering 2000" academic institutions need to train more minority students in the STEM field. The inclusion of *Climate Studies* course in the CAFSSS's academic program will certainly assist to train more minorities in environmental science studies. Climate Change related education is imperative in the context of current global environment change and there is high demand of minority young scientists with academic background in climate studies field. The goal of *AFE 366 Climate Change Studies* is to satisfy the national growing demand for skilled minority workforce in the use of principles and practical tools for studying climate change and analyzing weather related data for effective use and management of natural resources across the state and nation. Students will earn 3-credit hours upon the successful completion of this course. This course explores the history and mechanisms of climate change in Earth's past, as well as the methods that scientists use to investigate climate change. It focuses on Earth's natural climate changes over the past and the role that humans have had in changing climates. Students will investigate the relationships between human activity and climate change and the consequences when human and natural factors interact. Students discuss climate prediction models and explore possible solutions. This will help CAFSSS students to become responsible and scientifically-literate participants in the

discussions that dominate climate science today such as the potential impacts of global climate change that include shrinking glaciers and rising sea levels, changes in the Arctic environment, stronger and more frequent hurricanes, threats to marine life, global water-cycle disruptions, global greenhouse emission, and food security issues.

APPROACH

Recent studies on enrollment, retention, and graduation indicates that minorities are seriously under-represented in STEM-related discipline. The major reasons are psycho-social and academic-cum-administrative structural factors (including poor mentoring, advising and counseling) that lead students towards inadequate preparation for college education and low level of confidence in STEM disciplines. Prior studies suggest that active mentoring and project-based learning environment leads to substantially higher rates of college retention and timely graduation (Arnold et al., 2009; Dyer and Breja, 2003).

The course will be taught in an interactive way in both online and in-class environment. Blackboard Learn 9.1 Online system. Course materials and assignments will be made available in Blackboard. Instruction methods include blended teaching and learning tools via PowerPoint presentations, class or group exercise and online discussions, peer learning, group and individual projects. The course materials are made available in the form of PowerPoint presentations and hyperlinks of videos and websites for the relevant course materials. AMS's suggested textbook "Moran, Joseph M. (2010). *Climate Studies: Introduction to Climate Science." and the Investigations Manual* will be primarily used.

Reference course materials, web-links, and videos, PowerPoint lectures will be made available in the KYSU Blackboard and in the form of handouts. Some useful websites are: The US Climate Change Science Program (www.climatescience.gov), US Climate Change Technology Program (www.climatetechnology.gov); Real Climate (www.Realclimate.org); Science (www.sciencemag.org), NASA (www.nasa.gov) and NOAA (www.noaa.gov). Course website provided by American Meteorological Society (www.ametsoc.org) will be utilized for online tutorials, quizzes, exams and for reference materials.

STUDENT LEARNING OUTCOMES

Upon completion of this course, the student will be able to:

- define the scientific tools used to study global climate change in the past and present.
- describe the various lines of evidence that scientists use to investigate climate change in Earth's deep past.

- ❖ interpret the components, processes, and dynamics of the global heat budget as they pertain to the ocean/atmosphere system.
- ❖ analyze the conditions that led to extensive climate change over the past 2.5 million years.
- ❖ evaluate the purported human causes of climate change, the evidence surrounding that, and the likely consequences of human caused climate change.
- ❖ download, analyze, and interpret climate change related data from various sources and predict weather.
- ❖ understand climate change mitigation and adaptation policies for sustainable development and resource management

Students will be evaluated in their professional communication, critical thinking, reading and writing skills, online discussion, knowledge enrichment on subject matters, use of technology/software, and data analysis and interpretation skills. Diverse teaching methods and resource materials will be implemented. Teaching methods and resources such as lectures, both in-class and online discussions, case studies, group exercise/projects, websites information review, videos, field trips, online discussion board, and review and critique of articles, will be utilized for various course topics. Diverse assessment tools such as quizzes, homework, exams, class project and participation, short essays, critique of articles, use of online discussion, class attendance, and presentations will be implemented to evaluate each student's standing on learning outcomes.