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Workshop: Environmental Mathematics in the Classroom

In this proposal, we intend to call the attention to the question about how mathematics is playing, or can play a role in understanding and prediction of environmental events.

Mathematics has played a guiding role in the natural sciences for over 300 years; predictions of a given phenomena can be estimated only by analyzing the interrelation with the surroundings as well as by a logical analysis of the phenomena based on previous changes and/or results. In addition, we usually want to predict the consequences of altering our environment in some way; so, mathematics can play a basic-fundamental as well as applicative and deductive role in environmental science.

The physicist has two methods of making progress: (1) the experimental method based on observations, and (2) the method of mathematical reasoning. Building a mathematical model of a specific environmental event is similar to proposing a new theory for such an event. Instead of 'proving a new theory', we will center our first objective in 'validating a process/model' using mathematics, since mathematics can be considered a language to describe and record the events of nature.

Global climate change, natural resources management, ozone depletion, sustainable development, acid rain, air and water quality, and solid and hazardous waste management, are few of the better-known issues encompassed by environmental science. Obviously, this interdisciplinary field addresses interactions between people and nature.

Such types of prediction/validation involve: (a) the probability of some event with a variety of external factors, (b) solving equations, (c) considering rates of change in time and space, and (d) spatial or temporal variability of the event that we are trying to predict.

Calculus offers some of the most important mathematical tools for the analysis of natural problems; however, Calculus is perceived as difficult; it took about three centuries of arduous effort to develop calculus as an utilizable and well-founded discipline. Still today, math professors and scientists are working hard to facilitate the understanding of calculus. We have the provision of our elders' wisdom and we want to apply it to guide our students gradually toward the awareness of the subject; furthermore, our pedagogical and scientific interest to the current environmental events affecting our world and the needs of sustainable development inspired the present project/idea.

Goals of this Workshop:

As a result of this workshop, participants will:

1. Explore environmental challenges and social issues to develop projects that touch upon Mathematics curriculum and motivate students to participate.
2. Incorporate Miami Dade College's learning outcomes when preparing the projects.
3. Develop strategies that increase student motivation, retention and success.

Description:

In this workshop, the instructors will present a variety of applications that can be explored at different levels in the mathematics curriculum.

The applications could enhance courses from college prep through calculus and would include real-world data and interdisciplinary projects.

Interested faculty could teach Math in a way that contributes to develop quantitative literacy (LO2), critical thinking (LO) and environmental responsibility (LO10)

Activities:

Activities will involve a wide range of mathematical concepts and methods that include sets, equations, polynomials, linear and nonlinear functions, graphs, geometry, statistical analysis, and rates of change among others. These powerful tools will be utilized to model environmental problems related to economics, physics, biology and will involve current issues like population growth, everyday finances, environmental economics and oil spills. Math in the news will be touched as well.

References:

1. John Finnigan "Mathematical Sciences Symposium" at the University of NSW, 23 February 1996.
2. Carles R. Hadlock "Mathematical Modeling in the Environment", MAA, 1998.
3. B.A Fusaro and P.C. Kenschaft, Editors, The Mathematical Association of America, 2003.