ELEVENTH ANNUAL CAPSTONE DAY

Department of Mathematics
Georgia College

November 18, 2022
2 pm – 3:30 pm
A&S 2-70

Department of Mathematics
Georgia College

Earning a college degree is a significant achievement and requires dedication and tremendous effort by each student. Several programs have been developed to help students majoring in mathematics to succeed. The First Year Academic Seminar provides an introduction to department faculty, departmental and university expectations, policies, resources and opportunities following graduation. The department conducts informal social activities and presentations by faculty and guest speakers to encourage faculty and student interaction. The department webpage serves to inform, acknowledge and encourage student majors to become involved in activities related to the major such as mathematics competitions and professional meetings. The academic honor society Kappa Mu Epsilon has been organized to encourage and provide a supporting network for the student body.

Professional schools, businesses, government and industry recognize that mathematics majors are problem solvers and are highly skilled in the use of logic and reasoning. A degree in mathematics opens many careers that are closed to those without quantitative skills. Actuarial science stands as one major example. Moreover, the demand for mathematics in education-especially in secondary schools-is tremendous. In fact, the chronic nationwide shortage of mathematics teachers is due in part to the demand in so many other areas for talented mathematics majors.

2022 Capstone Day Schedule

2 – 2:05 pm Opening Remarks **A&S 2-70**

2:05 – 3:25 pm Session **A&S 2-70**

How Do Math Teachers Use Technology?**,** Jacob Carter

Predicting the Premier League Table**,** Nathan Moore

Comparing Teaching Methods in Different Level Classrooms to the Pirie and Kieren 'Growth in Mathematical Understanding' Framework, Kendel Mcauliffe

Mathematical Modeling of Different Pest Control Strategies, Kelsey Cadenhead

3:25 – 3:30 pm Closing Remarks **A&S 2-70**

2022 Capstone Day Abstracts

Kelsey Cadenhead

Mathematical Modeling of Different Pest Control Strategies

In this project, we formulate and analyze a mathematical model of a non-smooth system of differential equations representing the interaction between a pest and its natural enemy with different control strategies. Assuming that the natural enemy of the pest is a generalist predator (one that can feed upon an extensive group of prey and thrive in various environments), we describe their interaction by the continuous time model studied in the article, "*Bistability and limit cycles in generalist predator–prey dynamics",* Ecol. Complexity, 14 (2013), pp. 48-55. We introduce control strategies in the form of harvesting (catching/killing/chemical tactics) and releasing natural predators in the continuous time model when the density of the pest goes above a prescribed threshold. We compare different harvesting functions and threshold values that would result in the most efficient measure of pest control. We focus on parameter regimes where the continuous time model has multiple attractors and use analytical and numerical methods to analyze the dynamics of the model.

Jacob Carter

How Do Math Teachers Use Technology?

Technology has been an essential, yet contentious part of the mathematics classroom for a long time. Some teachers believe that students are often distracted by technology, while others believe it to be a crutch that gets in the way of developing strong number sense. However, many teachers propose that "technology can assist students in visualizing and understanding important mathematical concepts" (NCTM, 2014, p.82). In my research, I analyzed how secondary and undergraduate teachers of mathematics use technology in their classrooms including the types of technology they use and to what extent the teachers use it. I also investigated the roles that students and teachers took on when using technology, and the learning outcomes that were intended through their use of technology.

Kendel Mcauliffe

Comparing Teaching Methods in Different Level Classrooms to the Pirie and Kieren 'Growth in Mathematical Understanding' Framework

Pirie and Kieren advocate for complete understanding through the construction of knowledge in their Growth in Mathematical Understanding (1994) framework. They suggest that this framework describes how all students learn. However, regular classes (or "lower-level") have been stigmatized as not responding well to higher-level critical thinking teaching methods. This study aims to compare various levels of high school mathematics classes, investigate how different levels of students respond to teaching methods, and analyze the practical implications of this framework. This study analyzed data from observations and interviews of four different level teachers at Eastside High School to examine how this impacts students.

Nathan Moore

Predicting the Premier League Table

The Premier League is the top division in English football (soccer). It brings in a huge amount of revenue for each team, through television rights and so on. Therefore, the performance and result of each club is of great importance to them. Based on data over the past 20 seasons, this project aims to predict the points and finishing position of a team in the Premier League given a number of variables. By using statistical analysis tools, we are able to determine the importance of each variable, such as goals scored, goals conceded and net transfer spend, as well as fit regression and classification models to aid in our prediction. The goal ultimately being able to determine whether a team is most likely to be relegated, qualify for the Champions League, qualify for the Europa League or just finish mid-table.

Notes

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