GEORGIA COLLEGE

GEORGIA'S PUBLIC LIBERAL ARTS UNIVERSITY

CAPSTONE DAY

Department of Mathematics

Georgia College

December 1, 2012
8:00 AM - 2:15 PM
Kilpatrick Hall

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 newsletter, Sum News, 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 nation-wide shortage of mathematics teachers is due in part to the demand in so many other areas for talented mathematics majors.

2012 Capstone Day Schedule

8:00 - 9:00 Registration and Continental Breakfast   **Kilpatrick Auditorium**

9:00 - 9:20 Opening Remarks   **Peabody Auditorium**

9:20 - 10:20 Parallel Session I   **Kilpatrick 223**

      9:20-9:40 **Optimization in the Airline Industry,** *Brandon Witta*

      9:40-10:00 **Cantor: The Mathematician and the Set,** *Aubrey Kemp*

      10:00-10:20 **Metric Spaces and Continuity in Topology,** *Kara Jackson*

9:20-10:20 Parallel Session II   **Kilpatrick 226**

      9:20-9:40 **Use of Effective Questioning in the Mathematics Classroom,** *Kelsey Davis*

      9:40-10:00 **Making Our Partial Fractional Understanding of Fractions Whole,** *Rachel Waldron*

      10:00-10:20 **Inquiry Based Teaching Today Reflects the Moore Method**, *Alexandra Cain*

10:20-10:40 Coffee and Snack Break   **Kilpatrick Atrium**

10:40-11:40 Parallel Session III   **Kilpatrick 223**

      10:40-11:00 **Visualizing Mathematics through the Lens,** *Kendyl Wade*

      11:00-11:20 **Quipus and their Influence Seen through Mathematical Analysis**, *Laura Leon*

      11:20-11:40 **Chick-fil-A Nutrition Plan,** *Eric Cardoso*

10:40-11:40 Parallel Session IV   **Kilpatrick 226**

      10:40-11:00 **Demonstrating Knowledge and Understanding through Mathematical Writing,** *Elizabeth Carpenter*

      11:00-11:20 **Conceptual Understanding of Mathematics in America,** *Joseph Swearingen*

      11:20-11:40 **Investigating What Constitutes an Effective Math Teacher,** *Ashley Madden*

11:40-1:00 Lunch   **Kilpatrick Atrium**

1:00-2:00 Parallel Session V   **Kilpatrick 223**

      1:00-1:20 **Software Engineering for Computational Science and Engineering,** *Chelsea Davis*

      1:20-1:40 **The Rationality Theorem for Multisite Post-translational Modification Systems,** *Jackie Merriman*

      1:40-2:00 **Implicitly Defined Baseball Statistic**, *Joseph Scott*

1:20-2:00 Parallel Session VI   **Kilpatrick 226**

      1:20-1:40 **Hearing Impairment and ADHD: How they Affect Students' Ability to Learn Math**, *Catherine Stein*

      1:40-2:00 **Investigating Student Centered Teaching**, *Katherine Austin*

2:00-2:15 Closing Remarks   **Peabody Auditorium**

2012 Capstone Day Abstracts

Katherine Austin
Investigating Student Centered Teaching

It is imperative that teachers instruct students in such a way that their knowledge is challenged, deepened, and applied. My study investigates one teacher's perspective about the importance of engaging students in the mathematics classroom using an approach termed "student centered teaching." The benefits, questions, and struggles in implementing student centered teaching will be discussed along with how to practically apply this concept in the classroom.

Alexandra Cain
Inquiry Based Teaching Today Reflects the Moore Method

Today, the United States is faced with a disturbing dilemma regarding the mathematical knowledge of the youth of this country. Many mathematics and educational organizations think that the inquiry-based technique could help us in this problem. A pioneer to this technique, Robert Moore created a question of whether directed teaching as in lectures is really the best. An inquiry classroom can lead to a more mathematical understanding that could increase students' learning.

Eric Cardoso
Chick-Fil-A Nutrition Plan

Chick-fil-A is a popular fast-food restaurant among students at Georgia College. However, too much fast food carries health risks. We use current FDA guidelines for a two thousand calorie diet to examine possible diet choices at Chick-fil-A. We show that constructing a balanced diet according to these guidelines is impossible if one eats only at the Georgia College Chick-fil-A. Linear programming is used to model this problem and the mathematical language AMPL is used to solve the linear program. Extensions involving menu choices from Subway are also considered.

Elizabeth Carpenter
Demonstrating Knowledge and Understanding through Mathematical Writing

Writing in the mathematics classroom can be beneficial to students and their learning as well as to teachers and their knowledge of each student's level of understanding throughout the school year. Completing writing assignments in the mathematics classroom asks students to use metacognition, higher order thinking, and self-assessment which can benefit both students and teachers. Writing can take many different forms and the following will be discussed: journals, autobiographies, letters, and various informal assignments.

Chelsea Davis
Software Engineering for Computational Science and Engineering

There is a need for more efficient and reliable scientific software. We investigated whether or not design patterns are beneficial when writing scientific software. Developers were divided into two groups where one group used design patterns and the other did not. The programs that used design patterns had less fatal errors, greater complexity spread over a greater number of functions, and longer programs. We conclude that design patterns would be beneficial in writing scientific software and making it more efficient.

Kara Jackson
Metric Spaces and Continuity in Topology

Here, we take a look at the properties of metric spaces, topological spaces, and continuous functions. We will examine the Uniform Limit Theorem from topology which describes the behavior of sequences of continuous functions from topological spaces to metric spaces which converge uniformly to a function f. This resultant function is continuous. Specifically, this presentation will consider the case of uniform continuity over the uniform metric space. We shall prove the theorem holds for this case.

Kelsey Davis
Use of Effective Questioning in the Mathematics Classroom

The teaching of mathematics needs to move from traditional teaching methods and into methods that require students to think on a higher level. The method of questioning in mathematics can require students to form their own conjectures and ideas about concepts and can help students move from simply memorizing and taking notes on mathematics to "doing mathematics." In this study the lessons of an American classroom and a Japanese classroom are studied in depth along with the test scores of students from each of these nations in order to see the effects of effective questioning.

Aubrey Kemp
Cantor: The Mathematician and the Set

As with many mathematical ideas, the name of the Cantor Set is misleading. It sounds simple, easily understood, and for obvious reasons, like it was founded by a mathematician named Cantor. All of these assumptions about the Cantor Set are, in fact, wrong. The Cantor Set is one of paradoxes; and while the construction of this set is simple enough, the conclusions drawn from it are very complicated. In this paper we will discuss Georg Cantor's life, the history of the Cantor Set, its construction, and its applications in other subject areas.

Laura Leon
Quipus and their Influence Seen through Mathematical Analysis

The Incas, one of the most powerful ancient empires, remain a mystery in some aspects even today. With no written language to explain their intricate way of keeping records and accounting, the modern researcher relies on non-alphabetical evidence, the quipu. With deep analysis of the structure and use of the Quipus that have survived serve has a basis for understanding the unknown of the Incas. Quipus held all records for supplies available; they provided a way of organization for the different levels within the empire. The quipus of time, pachaquipus, show direct western influence on the native Incan culture. Quipus played a vital role in the core existence of the Incas.

Ashley Madden
Investigating What Constitutes an Effective Math Teacher

Everyday many students often question why mathematics is useful and wonder if it will ever be used beyond their years in school. Mathematical skills and knowledge train the brain in diverse areas not limited to strategic and analytical thinking and complex problem solving. A critical factor in the learning of mathematics is the effectiveness of the educators. A full knowledge of advanced mathematics qualifies the teacher in subject matter but does not necessarily make them an effectual educator. We will examine what constitutes an effective mathematics teacher. It is not only the knowledge of advanced mathematics that makes an effective teacher, but more importantly in combination with a deep understanding of the elementary mathematics they teach.

Jackie Merriman
The Rationality Theorem for Multisite Post-translational Modification Systems

A classical idea in Algebraic Geometry is the parameterization of algebraic sets by rational functions. We can apply this idea to the post-translational modification of proteins. Post-translational modification of proteins plays a fundamental role in cellular regulation but its study has been hindered by the increase in substrate modification forms. We will show that the steady-state modform concentrations establish an algebraic variety that can be parameterized by rational functions and give an example of how this can be done.

Joseph Scott
Implicitly Defined Baseball Statistic

In Major League Baseball, the batting champion is given to the player with the highest batting average. The Cy Young Award winner is given to the top pitcher and is determined by a combination of statistics including earned run average (ERA). The limitation of these statistics is that neither considers the opposing pitcher or batter. We develop two implicitly defined statistics that determine the value of a batter and the value of a pitcher based on the relative skill of the opposing pitcher and batter respectively. Eigenvector solutions to the eigenvalue problem, $Ax = \lambda x$, are used to generate each player's statistical value. This statistic relates a player's performance with the skill of the opposition and allows us to have to identify the best hitter and pitcher of a specific season.

Catherine Stein
Hearing Impairment and ADHD: How they Affect Students' Ability to Learn Math

Attention deficit hyperactivity disorder (ADHD) appears to be a common disability among students today, whereas hearing impairment is not as common but is no less important for teachers to consider when teaching mathematics. This paper is about how hearing impairment and ADHD affect student's ability to learn and do mathematics. The paper gives background information on each disability and explains how each disability affects student's ability to learn and do mathematics. Additionally, accommodation suggestions for teachers are included in this paper to give suggestions for improved mathematics teaching, and student learning for these particular disabilities.

Joseph Swearingen
Conceptual Understanding of Mathematics in America

Being able to teach and understand mathematics conceptually is essential for mathematics teachers. However, even though American teachers spend more time in mathematics classrooms as learners of mathematics than their Chinese counterparts, Chinese students have shown better understanding of the concepts they are taught and are better able to apply their knowledge than American students. Often the reason cited for this is how mathematics is presented to students in America. Mathematics in America is taught on a procedural level that lacks the depth needed to fully rationalize ideas and concepts. I believe that creating an environment for conceptual understanding, critical thinking, and a more productive disposition for the subject in this country is not only beneficial but imperative for the American education of mathematics.

Kendyl Wade
Visualizing Mathematics through the Lens

Throughout the centuries, mathematics has been seen by some as a sort of art. In this talk, we will delve into the process of molding the group law for a cubic curve and explore the beauty of it through photographic interpretation. The group law is composed of points on a plane cubic curve with the addition of a fitting binary operation. The series of photographs will look at different scenes where we can visualize the elements of the group law. I will explain my photographs and the interpretations after the discussion of the group law.

Rachel Waldron
Making Our Partial Fractional Understanding of Fractions Whole

Fractions are a fundamental aspect of mathematics, and a student's understanding or lack of understanding tends to follow from elementary school through college and to the real world. Students have always had difficulty understanding fractional concepts. The researcher contends that it is because of the instructional methods used to teach them. Research suggests that teachers who lack a conceptual understanding of fractions are unable to help students understand fractions in ways that allow them to use fractions beyond the classroom. The project aims to recognize the any weaknesses or strengths of prospective teachers with fractions.

Brandon Witta
Optimization in the Airline Industry

Many companies use advanced linear programing to improve the decisions they make, which ultimately saves money and resources. My project models how to effectively use linear programming to minimize fuel cost in the airline industry. In particular, the fuel cost to transport baggage to and from correct terminal facilities and gates once an aircraft has landed.

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DEPARTMENT OF MATHEMATICS