Abstracts for Contributed Papers: 2014 Section Meeting

(Note: due to scheduling constraints, some talks may be moved to other sessions)

Session: Undergraduate

Speaker: Tyler Gorshing
Title: Center of Non-Relativistic Lie Algebras
Abstract: In this talk, we use elementary multiplication of matrices to calculate the centers of some non-relativistic Lie algebras, namely the Schrödinger Lie algebra, the Galilei algebra and the Harmonic Oscillator Lie algebra.
Faculty Mentor: Guy Biyogmam

Speaker: Danny Somers
Title: Fumble! The Unpredictable Bounce Of a Football
Abstract: This paper looks into the direction and height at which a regulation sized NCAA football bounces disregarding physics.
Faculty Mentor: Nicholas Jacob

Speakers: Mikasa Barnes & Jonathan Yarbrough
Title: Paintings of Caterpillar Continua
Abstract: In the research performed, we count the number of nonhomeomorphic paintings of all caterpillar continua with n points of order greater than 2, for $n = 1, 2, 3,$ and 4 in an effort to determine the number of paintings for a general n.
Faculty Mentor: Michael McClendon

Speaker: Alanna Riederer
Title: A Mathematical Model of Circadian Rhythms in Drosophila
Abstract: We develop a comprehensive model of Circadian rhythms by gene interaction in Drosophila
Faculty Mentor: Brittany Bannish

Speaker: Bryan Dawkins
Title: A Mathematical Model and Analysis of the Adaptive Immune Response in Antitumor Laser Immunotherapy
Abstract: We present a mathematical model composed of a system of ordinary differential equations describing the immune-mediated dynamics of tumor cell populations with exponential growth. The model includes populations of several types of immune cells and both primary and metastatic tumor populations. We will present conditions for complete tumor clearance, initial tumor clearance and eventual recurrence, and tumor escape. We will show that key parameters of our model represent the effects of immune system stimulants that greatly impact the overall success of treatment. Model results will be compared to experimental data of our collaborator to show similarity under reasonable biological conditions.
Faculty Mentor: Sean Michael Laverty

Speaker: Raymond Jeter
Title: The Existence of a Continuous Function Whose Fourier Series Diverges at a Point
Abstract: There exists a continuous function whose Fourier series diverges at a point. In fact, the set of continuous functions whose Fourier series diverges at 0 is dense in $C([0,2\pi])$
Faculty Mentor: David C. Ullrich

Speaker: Jay Mayfield
Title: Motion of a non-linear spring with dynamical contact
Abstract: In this work, we study mathematical and numerical approaches to a nonlinear spring with dynamic contact. In our mathematical modeling, a nonlinear spring is attached to a wall. At the end of the spring, a mass is attached which may come into contact with a rigid obstacle. We also consider a lubricated surface, causing friction to be negligible. The equation of its motion with contact conditions is formulated in terms of a differential inclusion. Reformulating it into a time discretization and using the Euler methods and non-smooth Newton's method, numerical schemes are proposed to obtain numerical results.
Faculty Mentor: Jeongho Ahn

Speaker: Laura Beth McKinley
Title: More on "Derivative of Area Equals Perimeter": Coincidence or Rule?
Abstract: Describes how to use the Miller-Half Rule when finding the relationship between the derivative of the area and the perimeter of a shape with multiple partitions.
Faculty Mentor: Dean Priest

Speaker: Jaclyn Vanhook
Title: How Math Shapes Your World
Abstract: Eugene Wigner (Nobel Laureate – 1963) said, "The enormous usefulness of mathematics in the natural sciences is something bordering on the mysterious . . . There is no rational explanation for it." However, there have been a number of schools of thought developed in the attempt to explain this phenomenon. In this talk, we will take a brief look at three of these views on the effectiveness of mathematics in science.
Faculty Mentor: Sarah Marsh

Speakers: S. Gleen, A. Morales, T. Pleasant, L. Smith, T. Vaughn
Title: Applications of Least Squares Problems to Intensity Modulated Radiation Therapy Planning, Part I
Abstract: Brief overview of the application of Least Squares Problem (LSP) as applied to 3D-Intensity Modulated Radiation Therapy Planning (IMRT) will be presented in this part.
Faculty Mentors: Andrew Bucki, Abebaw Tadesse

Speaker: Khristen Anderson
Title: The Flight Path of a Volleyball: An Analysis of the Drag Crisis of Volleyballs in Service
Abstract: The study of the behaviors of sports balls has always been something that interests members of the scientific community. This can be seen in the extent to which tests have been done concerning soccer balls, baseballs, and golf balls. However, little attention has been given to the flight path of the volleyball. At the request of Dr. T.W. Cairns, the drag coefficient for a traditional 18 panel Wilson volleyball was determined by two aeronautical engineering students from the University of Michigan using a wind tunnel. The lift coefficient was also computed and published and so Cairns could plot pictures of serves by numerically solving the equation of motion. Subsequently, Molten and Mikasa have produced tournament approved balls with different surface patterns. The US Women's Olympic Volleyball Team has testified that the three different balls perform differently significantly during play. A different method for analyzing ball paths is to model the surfaces of the balls and perform simulations using Computational Fluid Dynamics (CFD) software. This method has successfully been used to model the flight characteristics of soccer balls, but never that of volleyballs. The goal of our study is to discover the flight patterns of the Molten and Mikasa balls using the star-CCM+ computer package
Faculty Mentor: Tom Cairns

Speaker: Kodi Liddell
Title: The Miller Half Rule and Its Extensions
Abstract: This is an exploration of the Miller Half Rule and its extensions to higher dimensions as well as its applications in optimization.
Faculty Mentor: Dean Priest

Speakers: S. Gleen, A. Morales, T. Pleasant, L. Smith, T. Vaughn
Title: Applications of Least Squares Problems to Intensity Modulated Radiation Therapy Planning, Part I I
Abstract: In this part, MATLAB Implementation of the (LSP)-IMRT on the computational environment for Radiation Therapy Research (CERR) platform will be presented. Sample patient image data from CERR Archives will be used for demonstration purposes.
Faculty Mentors: Andrew Bucki, Abebaw Tadesse

Speaker: John Kreidler
Title: Computational Thinking and Programming Approach in Teaching and Learning Processes
Abstract: In this presentation, some ideas of the new educational program in Mathematics based on computational thinking with programming approach and supporting STEM-C are presented. Elements of basic logic serve as illustrations of these ideas.
Faculty Mentor: Andrew Bucki

Speaker: Bailey Sinnett
Title: Successful States or Successful Schools
Abstract: This research is a statistical analysis of high school graduation rates organized by states across the country and common factors often blamed for the incompletion of high school within the expected four year time frame.
Faculty Mentor: Andrew Wells

Speaker: Amanda Morales
Title: Dynamics of HIV Infection
Abstract: In this talk, compartmental model of the dynamics of HIZ infection will be presented followed by some preliminary results on estimation of HIV model parameters using interruption trial data including drug efficacy and reservoir dynamics.
Faculty Mentors: Abebaw Tadesse, Andrew Bucki, Alonzo Peterson

Speaker: Staci Gleen
Title: How Far is a Chicken McNugget from being Prime?
Abstract: Numerical monoids have long been studied for their interesting (i.e., non-unique) factorization properties. While numerical monoids of embedding dimension 2 are relatively well-understood, the presence of a third minimal generator makes these monoids more difficult and interesting to study. We provide a complete analysis of $M^cN = < 6,9, 20 >$, an embedding dimension 3 numerical monoid whose elements correspond to the amounts of Chicken McNuggets one can purchase using the traditional order sizes of 6, 9, and 20. Our analysis includes a closed formula for $\omega(x)$, the omega-primality of an element, which measures how far that element is from being prime in the monoid. Furthermore, we also develop formulae for the elasticity $\rho(x)$ and delta sets $\Delta(M^cN)$, quantities which measure non-uniqueness of factorizations in M^cN. After presenting computational data, we will also provide conjectures for more general classes of embedding dimension 3 numerical monoids.
Faculty Mentors: Andrew Bucki, Abebaw Tadesse, Alonzo Peterson

Speaker: Bobby Carnes
Title: Fibonacci Sequence and its Generating Function
Abstract: This research includes an overview of the Fibonacci Sequence. The origin, recursive form, and its generating function are explored. A proof of its generating function is included.
Faculty Mentor: Andrew Wells

Speaker: Kendra Parker
Title: Jacobi vs. Gauss-Seidel
Abstract: This paper talks about two different numerical methods used to solve systems of linear equations, the Jacobi Method and Gauss-Seidel Method. The methods are compared by looking at the solutions, how many iterations are needed to obtain the solutions, and the relative and absolute error.
Faculty Mentor: Robert Ferdinand

Speaker: Stephanie Duncan
Title: Curriculum Integration and the Mathematics Classroom
Abstract: This research paper discussed the variety of ways local junior high and high school mathematics teachers incorporated curriculum integration into their classroom activities.
Faculty Mentor: Mary Harper

Speaker: Kendall Dobbs
Title: Mathematics Self-Efficacy: Is Math Class Hard?
Abstract: My theses research project was inspired by my many years of one-on-one tutoring in and out of the classroom. Through these experiences, I have come to realize the importance of mathematics self-efficacy and the role it plays for each individual. In order to understand mathematics self-efficacy and how it affects a student, my faculy mentor and I created a questionnaire to be disbursed to approximately 100 participants from four different undergraduate mathematics courses. The questionnaire consisted of seven questions ranging in topics from mathematics self-efficacy, mathematics anxiety, and a negative feeling towards mathematics and had a moderate mathematics self-efficacy level. These feelings and levels were found to be influenced mainly by prior experiences, such as grades, teachers, and tests. After the discussion of my findings, I also reported suggestions on how mathematics educators can boost mathematics self-efficacy levels for their sutdents.
Faculty Mentor: Mary Harper

Speakers: Stephanie Bayne, Matt Garner, Vikki Orso
Title: A Teacher's Perspective: The Impact of Common Core
Abstract: The research is about a teacher's perspective of Common Core. We want to know the impact on students from Common Core told from the teachers point of view.
Faculty Mentor: Mary Harper

Speaker: Trent A. Rogers
Title: The Two-Handed Tile Assembly Model is Not Intrinsically Universal
Abstract: In this paper, we show for a particular model of self-assembly, there is an infinite hierarchy of classes with increasing power. In order to accomplish this, we define notions of simulation and intrinsic universality.
Faculty Mentor: Matthew Patitz

Speaker: Douglas Bohlman
Title: Introduction to Spectral Analysis of Graphs
Abstract: Simple, finite graphs are algebraic objects that can be powerfully utilized in modeling complex networks. We explore the structure of such graphs with a variety of matrix representations and discuss the vector space interpretation of node- and edge-sets, as well as decomposition into orthogonal subspaces. Finally, we discuss graph eigenvalues and their connection to global structure.
Faculty Mentor: Edmund Harriss

Speaker: Emily Coats
Title: Occurrences of Sierpinski's Triangle
Abstract: This paper is about the fractal Sierpinski's Triangle and its properties, such as self-similarity and Hausdorff dimension. Different occurrences of the pattern are explored, particularly in Pascal's Triangle modulo 2, the Chaos Game, and a transformation from the Cantor Set.
Faculty Mentor: John Akeroyd

Speaker: Frederick McCollum
Title: Smooth Interpolation of Data: Minimal Lipschitz Extensions
Abstract: Using results from classical analysis and techniques from computational geometry, we have designed an algorithm for computing optimal interpolants in C^{1,1}(R^d). The results of this research could be used in the design of experiments in applied physics and chemistry.
Faculty Mentor: Mark Arnold

Speaker: Matt Lukac
Title: Continuously Diagonalizing the Shape Operator
Abstract: We will be investigating the curvature of surfaces in $\mathbb{R}^3$ using a 2×2 symmetric matrix known as the shape operator. We will see the conditions meeded to diagonalize the shape operator in a neighborhood of the origin and what this implies.
Faculty Mentor: Phil Harrington

Speaker: Madison Sandig
Title: Origami, Surfaces and Curvature
Abstract: An exploration through surfaces that can be represented through origami and the curvature of these surfaces.
Faculty Mentor: Edmund Harriss

Speaker: Matt Hartley
Title: Using the Metropolis-Hastings Algorithm to Analyze Galaxy Morphology
Abstract: A short discussion of the function Metropolis-Hastings algorithm with a description of the application of the algorithm to the specific context of analyzing the morphology of spiral galaxies.
Faculty Mentor: Edmund Harriss

Speakers: Chase Roberts & Sarah Zimmerman
Title: Modeling in Calculus Using Approximation Curriculum: A Close Look at a Derivative Lab
Abstract: We describe a research-based approximation approach to calculus to help make calculus conceptually accessible to more students while simultaneously increasing the coherence, rigor, and applicability of the content learned in the courses. In this talk we take a close look at a lab designed to support student discovery of key ideas related to the notion of derivative in the context of rates of change.

Speaker: Gage Rice
Title: Detecting Handwriting Forgeries Using Discrete Wavelet Transformations
Abstract: Discrete wavelet transformations, used along with statistics, can be used to detect handwriting forgeries with a great degree of accuracy. The field of wavelet theory is a relatively new one that gained a footing in the mathematical community in the mid 1980's. Work in wavelet theory, and the wavelet transformations that followed, have led to many advances in the compression, denoising, and detection of edges in images. In our work, we took handwriting samples from a handful of sources and made forgeries of the given samples. From there, all of the handwriting samples were scanned into the computer where we used Matlab to perform discrete wavelet transformations on them. After this, the weights and respective errors for the linear predictors were calculated and we used a one-way ANOVA test to compare the skewness of the samples with their associated forgeries.
Faculty Mentor: Jill Guerra

Speaker: Mary Jo Galbraith
Title: An Exploration of Generalized Parabolas
Abstract: A generalized parabola is the set of all points that are equidistant from a given point, the focus, and a given curve, the directrix. In this presentation, we explore the different generalized parabolas that result from using directrixes from many different families of curves. We look at the similarities between these generalized parabolas when the directrix remains fixed and the focus is allowed to occupy any point in the plane, as well as the patterns that develop from iterating generalized parabolas about the same focus.
Faculty Mentor: Nicholas Zoller

Session: Graduate

Speakers: Kathryn Blair & Emily Goins
Title: Universal Design for the Mathematics Classroom
Abstract: In our desire to better serve students with disabilities, we were introduced to Universal Design -- creating curriculum and learning environments that improve opportunities for all students. Through our researching, we compiled suggestions to structure mathematics classrooms and curriculum that will benefit all.

Speaker: Delong Li
Title: Continuous Everywhere but Differentiable Nowhere Functions
Abstract: In this presentation, we consider a classical problem in real analysis: the construction of continuous but differentiable nowhere functions. We use an approach developed by Kiesswetter in 1966 and find the generalized Kiesswetter's functions. We establish a criterion for such generalizations and show how such functions can be understood geometrically.

Speakers: Martha Watkins & Minette Crawford-Krone
Title: Quantitative Reasoning
Abstract: Quantitative literacy is a valuable life skill. Quantitative Reasoning – 1313, is a new course offered at UAF, and may be taken instead of college algebra to fulfill the one math requirement that many students must complete to graduate. This paper will examine the new course, and will present information pertinent to quantitative reasoning.

Speaker: William Taylor
Title: Painting Cubes
Abstract: In this paper we examine the problem of painting the faces of cubes with different colors in such a way that the cubes can be arranged to form a larger cube in n different ways, each of which has all exterior faces the same color. We will examine the cases n=1, n=2, and n=3 via explicit construction. Using combinatorics and polynomial theory, we will show how we can inductively and non-inductively construct such colorings for larger collections of cubes and colors.

Speaker: Rebecca Martin
Title: The Development of Student Understanding of Function in a Semester of College Algebra
Abstract: Over a single semester, two College Algebra classes were a part of a study of student understanding of function. Student understanding of function was categorized into four levels based on past research. These categories separate students by their working definition of function and their ability to recognize and represent functions. Their level of understanding was assessed periodically throughout the semester using a pre/post survey and five tasks including two graphing activities, two identification tasks, and a matching activity. Each student's categorization based on tasks throughout the semester was analyzed and compared to their performance on assessments and activities. Results were analyzed to determine how student understanding changed and whether it had an effect on their overall performance. It was found that students progressed to higher levels of understanding of function, although whether the level of understanding of function was connected to performance in the class was inconclusive.

Speaker: Jordan Karpe
Title: Reinventing a Definition for Sequence Convergence: Knowing vs. Understanding
Abstract: Students in an introduction to real analysis course were asked to create a formal definition for sequence convergence. Unexpectedly, one student's early accuracy did not translate into a faster re-definition. This presentation details how she relented her mathematical authority, thus stunting her progress. Through the reinvention activities she later regained authority, as she understood how her pre-existing definition components resolved problems.

Session: General

Speaker: John Watson
Title: Great Mathematics for Young (and eager) Minds
Abstract: Children should be informed at an early age that mathematics is more than the four basic arithmetic operations. Euler's formula for polyhedra provides a means to demonstrate this. Using JOVO "click'n construct" pieces, first graders in Russellville, AR and in the tsunami stricken city of Ofunato, Japan were given the opportunity to build their own polyhedra and see Euler's formula first hand.

Speaker: Fred Worth
Title: Fun with Fibonacci
Abstract: We will look at the Fibonacci Sequence and a number of interesting properties that arise within the sequence.

Speaker: Fred Worth
Title: Statistical Oddities in Baseball History
Abstract: Baseball history has seen a number of statistical anomalies. We will look at some of these that this presenter deems interesting.

Speaker: Demitri Plessas
Title: The Mathematics of Procedural Generation in Videogames
Abstract: Procedural generation is a technique that uses a pseudorandom number generator to construct content. In games this content comes in many forms, such as the structure of the world, encounter placement, and the graphical textures used. Procedural generation has been a part of videogames since 1984, but has recently become a popular technique in independently produced games. We will investigate the mathematics behind procedural generation and highlight the mathematical issues that procedural generated content in games face.

Speaker: Michael Lloyd
Title: Error from the Welch-Satterthwaite Approximation
Abstract: The Welch-Satterthwaite Equation gives the degrees of freedom association with a 2-sample t procedure as often taught in an introductory statistics course. The derivation and associated error with approximating the test statistic using the t distribution will be given.

Session: Algebra

Speaker: Guy Roger Biyogmam
Title: A Study of Intuitionistic Fuzzy n-racks
Abstract: Intuitionistic fuzzy sets were introduced by Atanassov and have been developed in many fields from applied physics to pure mathematics. In the

latter, intuitionistic fuzzy sets have been applied to several algebraic notions such as groups, equivalence relations, congruences, and many more. In this talk, we will discuss how this concept applies to n-racks. This includes the characterization of intuitionistic fuzzy n-racks in terms of level sets (which turn out to be n-subracks). We will also examine notions such as normality and maximality of intuitionistic fuzzy n-racks.

Speaker: Duff Campbell
Title: Patterns in Continued Fractions for $\sqrt{n}$
Abstract: When teaching number theory, I ask my students to find patterns in the (infinite, repeating) continued fractions for $\sqrt{n}$. Recently, students found patterns that I had not seen before, and that made me look for even more. There are five "classical" patterns; I will show about 30 other patterns.

Session: Analysis

Speaker: Tom McNamara
Title: Representations of the Euclidean Group
Abstract: We examine the full Euclidean group of isometries on $\mathbf{R}^n$ including_both rotations and translations. We make use of the machinery developed by G. W. Mackey to find all irreducible unitary representations of this group.

Session: Applied Math

Speaker: Jean-Jacques Kengwoung-Keumo
Title: Poor Performance of the Least Squares Nonlinear Regression Method in the Presence of Outliers and/or Influential Observations
Abstract: We analyze the poor performance of the least squares nonlinear regression method when outliers are present. Then we propose a new alternative robust nonlinear regression method that provides accurate parameter estimates when outliers and/or influential observations are present. Using real data for drug concentration data we show the accuracy of our robust technique compared to the least squares. The new method is robust, simple and appropriate for the analysis of nonlinear regressions.

Speaker: Nicholas Jacob
Title: Picard-Lindelöf Solutions to Differential Equations
Abstract: Abstract methods of solving differential equations require restrictions on the time interval of the solutions. Applying the proof of Picard-Lindelöf allows for a weakening of those restrictions. Application to a Hamiltonian system will be presented along with other consequences of the result.

Speakers: Abebaw Tadesse & Andrew Bucki
Title: Applications of Ensemble Based Simulated Annealing to Three Dimensional Intensity Modulated Radiation Therapy Planning
Abstract: In this presentation, a brief overview of the Ensemble Based Simulated annealing algorithm (EBSA) as applied to 3D-Intensity Modulated Radiation Therapy Planning (IMRT) will be presented. Particular emphasis is given to the problem of interfacing the EBSA-IMRT planning algorithm as an external solver to the CERR (Computational Environment for Radiation Therapy Research) platform. Anonymized image data available at the CERR archive will be used to demonstrate main interfacing feature.

Session: Topology

Speaker: Ray Hamlett
Title: Ideals in Topological Spaces
Abstract: Some common ideals in topological spaces are defined and important properties described (such as the Banach localization property) , and some theorems are enumerated including the Jankovic-Hamlett result that in any space, if an ideal has the Banach localization property, then so does its sigma extension. If time permits, then the associated "star" topology will be discussed as a rich source of examples.

Speaker: Andy Miller
Title: On the Space of Euclidean Triangles
Abstract: The set of similarity classes of triangles in the Euclidean plane forms a 2-orbifold. I will describe this fact, which is perhaps not as well-known as it should be, and show its use in understanding certain constructions of triangles.

Speakers: Andrew Bucki & Abebaw Tadesse
Title: Special Topological Groups
Abstract: In this presentation we will show the existence of certain endomorphisms of tangent spaces of some topological groups leading to geometrical properties of these groups.

Session: Mathematics Education and Classroom Notes

Speaker: Michael M. Dougherty
Title: Function diagramming and empty parentheses
Abstract: In this talk I give some examples and anecdotes regarding my attempts at a pedagogically useful system for flow charting functions that I use in my classes. I also mention how some students respond well to "empty parentheses" notation for presenting a function, where for instance rewriting $f(x)=2x+5$ as $f(\ )=2(\ )+5$ helps to avoid mistakes such as when computing $f(x+h)$.

Speaker: J.C. Price
Title: Flipping Calculus
Abstract: What should replace lecture if it is removed from the classroom? This is the question we faced this year when we put screencasts of our calculus lectures on YouTube at www.youtube.com/user/drprice765. In this talk we will discuss how we incorporated inquiry-based learning techniques and transformed our traditional homework sets to create an active learning environment, in which students could openly discuss mathematics, compare and contrast ideas, and work together to solve problems.

Speaker: John C.D. Diamantopoulos
Title: Preliminary Report on Flipping the Classroom: Abstract Algebra
Abstract: Instead of approaching my section of abstract algebra in a totally traditional way, I decided to "flip" the classroom. I did this in a somewhat different manner than I'd really ever heard of others using when "flipping" their classes. I will discuss what I implemented, things that worked well…some that didn't, and have an open discussion of implementations that others are using.

Speaker: Deborah Korth
Title: The Benefits Course-Wide Collaborative Planning
Abstract: Graduate Assistants and Instructors are a transient group of teachers. Every semester, there is a new lot to train and a talented group who find greener pastures. In order to capitalize on the talents of the experienced teachers and ensure mentoring new hires, we form collaborative teaching teams among all people assigned to teach specific service courses. These teams plan together, teach together, and support each other. In this session we will discuss how the teams are formed, how they work together, and how they have been able to improve instruction across all sections of the service mathematics courses.

Speaker: Brittany Bannish
Title: Hands-on Classroom Demonstrations for a Life Sciences Calculus Course
Abstract: We present examples from a small catalog of successful in-class demonstrations for a sophomore level bio-calculus class. Our goal is to generate excitement and intuition for mathematical concepts and methods.

Speaker: Sarah Marsh
Title: Fostering Second Chances: An Unconventional Approach to Assessment in a "Math for Elementary Teachers" Course
Abstract: Students often request opportunities to offset poor exam performances, such as the ability to re-do exam questions for additional credit. However, in my "Math for Elementary Teachers" course, I turn the tables by *requiring* students to re-do their unsuccessful attempts at exam questions. This talk will cover the background motivating this approach, the details of the policy itself, some pros and cons to this method to assessment, and reactions from both students and faculty.

Speaker: Gene Dugger
Title: Using the One-Room Schoolhouse Approach in Summer School
Abstract: Combining four classes into the same room at the same time; Beginning Algebra, Intermediate Algebra, College Algebra, and Trig. None would make it on their own. Main challenges: 1) Answer any questions that come up; 2) Good classroom management software (I use Aleks).

Speaker: Samantha Robinson
Title: A Statistical Outlier: An Approach to Successfully Re-sequencing Main Topics in Introductory Statistics Courses
Abstract: After teaching several collegiate statistics courses, I realized that, in following the typical textbook presentation of the material closely, students are often ill equipped for any true data analysis or undergraduate research until well into the semester if at all. The delayed introduction of confidence interval estimation and hypothesis testing meant that students, often, failed to see the big picture or conceptualize the reasoning behind what they were initially learning. This led to the idea of re-sequencing the order in which I taught the core statistical concepts of the course. This re-sequencing, along with an incorporation of several projects, has been very successful in terms of increasing student engagement, comprehension, statistical knowledge, and perceived practical utility of the course. In this talk, I will discuss the need for re-sequencing statistics courses, the ways in which this re-sequencing is accomplished, the observed benefits of the new course structure, and possibilities for future work. In addition, I will provide a framework for ordering the topics including an example topic sequence and associated projects.

Speaker: Jack L. Jackson II
Title: Using the Cumulative Density Function and Technology in Elementary Statistics
Abstract: When working with continuous probability distributions most elementary textbooks in statistics emphasize the use of the probability density function (PDF) and little attention is given to the more useful and accessible cumulative density function (CDF). The presenter will demonstrate techniques for introducing and using the CDF in introductory statistics classes and will illustrate its usefulness in calculations in conjunction with a TI-84. This combination of tools and techniques allows introductory statistics students to quickly calculate probabilities and inverse probabilities for a wide variety of continuous distributions, including those most often used in hypothesis testing, all accurate to the limits of the calculator.

Speaker: Anita Walker
Title: A Duck's Journey
Abstract: The pathway of a duck crossing a river is modeled by a pair of differential equations. The problem is accessible to undergraduates.

Session: Research in Undergraduate Math Education

Speaker: Lisa Mantini
Title: Instructional Practices and Student Performance in Calculus I
Abstract: Classroom teaching in multiple sections of Calculus I at a large, comprehensive research university was observed and coded during two recent semesters using the Teaching Dimensions Observations Protocol. Multiple lecture-based teaching styles were observed, with a wide variation in levels of student work observed during class periods and in observed student response to instructor questions. Teaching styles were categorized as low engagement, moderate engagement, and high engagement. Significant correlations were found between certain aspects of high-engagement instructional practice and student performance on uniform exams and on the Calculus Concepts Inventory.

Speaker: Myron Rigsby
Title: What Do Teachers Think? Teacher Perspectives on Common Core Implementation
Abstract: Participants in a multi-year professional development program for secondary mathematics teachers were surveyed regarding the implementation of the Common Core State Standards in Mathematics. Topics surveyed included self-confidence in CCSS-M content, anticipated problems in implementation, anticipated changes in teaching methods, and utility of various professional development strategies.

Speaker: Sepideh Stewart
Title: Teaching Linear Algebra with Clickers in three Worlds of Embodied, Symbolic and Formal Mathematical Thinking
Abstract: Linear algebra is one of the first advanced mathematics courses that students encounter at university. Research shows that although many students find the calculation side of the course, specially manipulating matrices relatively straightforward, they lack the theoretical understanding of basic linear algebra concepts. In this research we have employed Tall's framework of three worlds of embodied, symbolic and formal mathematical thinking to analyse students' thinking processes and suggest ways forward in teaching linear algebra. As part of this study, we integrated clickers into teaching two groups of linear algebra students to investigate whether the order (formal definitions and theorems, symbolic representations, pictures and geometry) in which the main linear algebra concepts are presented has an impact on students' learning.